### 2009 Sacramento Valley Regional Water Management Plan Annual Update

#### **Preface**

This 2009 Sacramento Valley Regional Water Management Plan Annual Update (2009 RWMP Annual Update) was prepared by the Sacramento River Settlement Contractors (SRSC) in cooperation with the U.S. Bureau of Reclamation, in accordance with the Regional Criteria for Evaluating Water Management Plans for the Sacramento River Contractors (Regional Criteria). This 2009 RWMP Annual Update is the first update to the Sacramento Valley Regional Water Management Plan (RWMP) that was completed in 2007. The Regional Criteria specify that beginning one year after acceptance of the RWMP, the participating SRSCs will jointly file an annual update every subsequent year to report on implementation actions taken, along with any additions and revisions to the RWMP. Accordingly, this 2009 RWMP Annual Update includes updated information and status on numerous topics included as part of the RWMP.

Following are the participants in the RWMP and this 2009 RWMP Annual Update:

- Anderson-Cottonwood Irrigation District
- Glenn-Colusa Irrigation District
- Provident Irrigation District
- Princeton-Codora-Glenn Irrigation District
- Reclamation District No. 108
- Reclamation District No. 1004
- Meridian Farms Water Company
- Sutter Mutual Water Company
- Pelger Mutual Water Company
- Natomas Central Mutual Water Company

This 2009 RWMP Annual Update reflects advancements and updates to projects and practices identified in the RWMP and focuses on the following this year:

- Update of Cooperative Water Measurement Study
- Inclusion of new projects and update of proposed project status
- Review of all Quantifiable Objectives (QO) and Targeted Benefits (TB)
- Update of all water management practices
- Update of Sacramento Valley Water Management Coalition monitoring program
- Update of typical proposed project baseline flow approach

This document is intended to be used in conjunction with the existing RWMP (an electronic copy is provided in Appendix A to this 2009 RWMP Annual Update). Preface Table 1 identifies all section headings included in the RWMP and indicates which subsections have been revised as part of this 2009 RWMP Annual Update. A brief description of the changes

made for each section is also provided. Where a revision is made to the RWMP, the revised paragraph is shaded. Relevant surrounding text is also provided, excluding tables and figures that did not require revision.

PREFACE TABLE 1
Document Organization and Description of Changes
2009 Sacramento Valley Regional Water Management Plan Annual Update

			RWMP Section	Information Updated in this 2009 RWMP Annual Update?
1.0	Reg	ional De	escription and Resources	Yes, see subsections below
	1.1	History	y and Sub-basin Description	No
		1.1.1	Redding Sub-basin	No
		1.1.2	Colusa Sub-basin	No
		1.1.3	Butte Sub-basin	No
		1.1.4	Sutter Sub-basin	No
		1.1.5	American Sub-basin	No
		1.1.6	Colusa Drain Mutual Water Company	No
	1.2	Surfac	e Water and Groundwater Resources	No
		1.2.1	Surface Water Resources	No
		1.2.2	Groundwater Resources	No
	1.3	Typica	ll District Facilities	Updated District/Company facility information
	1.4	Topog	raphy and Soils	No
		1.4.1	Topography	No
		1.4.2	Soils	No
	1.5	Climat	е	No
	1.6	Natura	al and Cultural Resources	No
		1.6.1	Natural Resources	No
		1.6.2	Cultural Resources	No
	1.7		ting Rules, Regulations and Agreements that Affect Availability	No
		1.7.1	Surface Water Resources	No
		1.7.2	Groundwater Resources	No
	1.8	Water	Measurement, Pricing, and Billing	Yes, see subsections below
		1.8.1	Measurement Practices	Updated Table 1-4 to create an inventory of flow measurement devices, and moved completed table to Section 2.0

			RWMP Section	Information Updated in this 2009 RWMP Annual Update?
		1.8.2	Pricing Structures and Billing	Updated Table 1-6 with new pricing rates from each SRSC
	1.9	Water	Shortage Allocation Policies	No
		1.9.1	CVP Sacramento River Contract Supply Requirements	No
		1.9.2	Criteria for Defining Water Availability	No
	1.10	Water	Quality	No
		1.10.1	Surface Water Quality	No
		1.10.2	Groundwater Quality	No
2.0	Sub-	-basin W	/ater Use, Supply, and District Descriptions	Yes, see subsections below
	2.1	Reddin	g Sub-basin	Yes, see subsections below
		2.1.1	Water Supply within the Redding Sub-basin	No
		2.1.2	Water Use within the Redding Sub-basin	No
		2.1.3	Anderson-Cottonwood Irrigation District	Provided changes to water use and supply
	2.2	Colusa	Sub-basin	Yes, see subsections below
		2.2.1	Water Supply within the Colusa Sub-basin	No
		2.2.2	Water Use within the Colusa Sub-basin	No
		2.2.3	Glenn-Colusa Irrigation District	Provided changes to water use and supply
		2.2.4	Provident Irrigation District	Provided changes to water use and supply
		2.2.5	Princeton-Codora-Glenn Irrigation District	Provided changes to water use and supply
		2.2.6	Reclamation District No. 108	Provided changes to water use and supply
	2.3	Butte S	Sub-basin	Yes, see subsections below
		2.3.1	Water Supply within the Butte Sub-basin	No
		2.3.2	Water Use within the Butte Sub-basin	No
		2.3.3	Reclamation District No. 1004	Provided changes to water use and supply
	2.4	Sutter	Sub-basin	Yes, see subsections below
		2.4.1	Water Supply within the Sutter Sub-basin	No
		2.4.2	Water Use within the Sutter Sub-basin	No

#### PREFACE TABLE 1

			RWMP Section	Information Updated in this 2009 RWMP Annual Update?
		2.4.3	Meridian Farms Water Company	Provided changes to water use and supply
		2.4.4	Sutter Mutual Water Company	Provided changes to water use and supply
		2.4.5	Pelger Mutual Water Company	Provided changes to water use and supply
	2.5	Americ	can Sub-basin	Yes, see subsections below
		2.5.1	Water Supply within the American Sub-basin	No
		2.5.2	Water Use within the American Sub-basin	No
		2.5.3	Natomas Central Mutual Water Company	Provided changes to water use and supply
3.0	Reg	ional W	ater Measurement Program	Yes, see subsections below
	3.1	Plan Id	dentification	Provided current results of Cooperative Water Measurement Study
	3.2		sed Cooperative Water Measurement Study urement Plan Evaluation	Provided current results of Cooperative Water Measurement Study
	3.3	Plan S	Selection	Provided current results of Cooperative Water Measurement Study
		3.3.1	Year 1 (2006-2007) Progress Report	Provided current results of Cooperative Water Measurement Study
		3.3.2	Year 2 (2007-2008) Progress Report	Provided current results of Cooperative Water Measurement Study
		3.3.3	Final Report	Provided current results of Cooperative Water Measurement Study
4.0		lysis of ectives	Sub-region Water Management Quantifiable	Yes, see subsections below
	4.1	Develo	opment of CALFED Targeted Benefits	No
		4.1.1	Purpose	No
		4.1.2	Targeted Benefits and Quantifiable Objectives	No
		4.1.3	Sacramento Valley Water Quality Coalition	No
	4.2	Identif	pating Sacramento River Settlement Contractor ication of Applicable Targeted Benefits and Associated ifiable Objectives	Provided status of grower education program

			RWMP Section	Information Updated in this 2009 RWMP Annual Update?
		4.2.1	Sacramento River Basinwide Water Management Plan	No
		4.2.2	Sacramento Valley Water Management Agreement and Program	No
		4.2.3	Development of Quantifiable Objectives	Table 4-1 updated with summary for all new and existing projects
		4.2.4	Redding Sub-basin	Updated with current Targeted Benefit analysis
		4.2.5	Colusa Sub-basin	Updated with current Targeted Benefit analysis
		4.2.6	Butte Sub-basin	Updated with current Targeted Benefit analysis
		4.2.7	Sutter Sub-basin	Updated with current Targeted Benefit analysis
		4.2.8	American Sub-basin	Updated with current Targeted Benefit analysis
5.0			of Actions to Implement and Achieve Proposed Objectives	Yes, see subsections below
	5.1	Reddin	ng Sub-basin	Yes, see subsections below
	5.2	ACID (	Churn Creek Lateral Improvements Project	Updated project description, schedules, and budget
	5.3	ACID N	Main Canal Modernization Project	Updated project description, schedules, and budget
	5.4	ACID (	Conjunctive Water Management Program	Updated project description, schedules, and budget
	5.5	Colusa	Sub-basin	Yes, see subsections below
	5.6	GCID I	Main Canal Modernization Project	Updated project description, schedules, and budget
	5.7	GCID (	Conjunctive Water Management Program	Updated project description, schedules, and budget
	5.8	GCID (	Colusa Basin Drain Regulating Reservoir Project	Updated project description, schedules, and budget
	5.9	RD-108	8 Conjunctive Water Management Program	Updated project description, schedules, and budget
	5.10	RD-108	8 Flow Control and Measurement Project	Updated project description, schedules, and budget
	5.11	PCGID	Conjunctive Water Management Program	Updated project description, schedules, and budget

	RWMP Section	Information Updated in this 2009 RWMP Annual Update?
	5.12 PID Conjunctive Water Management Program	Updated project description, schedules, and budget
	5.13 Butte Sub-basin	Yes, see subsections below
	5.14 RD-1004 Canal Lining Project	Updated project description, schedules, and budget
	5.15 RD-1004 Conjunctive Water Management Program	Updated project description, schedules, and budget
	5.16 Sutter Sub-basin	Yes, see subsections below
	5.17 MFWC Conjunctive Water Management Program	Updated project description, schedules, and budget
	5.18 SMWC Irrigation Recycling Project	Updated project description, schedules, and budget
	5.19 SMWC Canal Lining Project	Updated project description, schedules, and budget
	5.20 SMWC and RD 1500 Joint Sutter Basin Groundwater Management Program	Updated project description, schedules, and budget
	5.21 PMWC Conjunctive Water Management Program	Updated project description, schedules, and budget
	5.22 American Sub-basin	Yes, see subsection below
	5.23 NCMWC Conjunctive Water Management Program	Updated project description, schedules, and budget
6.0	Establishment of Monitoring Program	Yes, see subsections below
	6.1 Proposed Water Measurement Programs	Updated status of baseline flow determination
	6.2 Water Quality and the Sacramento Valley Water Quality Coalition	Updated status for the Sacramento Valley Water Quality Coalition monitoring program
	6.2.1 E. coli Monitoring Plan	Updated status for the Sacramento Valley Water Quality Coalition monitoring program
	6.2.2 Diazinon Management Plan	Updated status for the Sacramento Valley Water Quality Coalition monitoring program
	6.2.3 Yolo County Technical Report	No
	6.2.4 Localized Monitoring	No

	RWMP Section	Information Updated in this 2009 RWMP Annual Update?
7.0	Proposed Budget and Allocation of Regional Costs	Updated the conservation budget on the basis of estimates of staff, time, and materials used for conservation; included estimated amount spent last year (Table 7-1) and projected budget and staff time summary for next 2 years (Table 7-2)
8.0	RWMP Coordination	Updated Table 8-1; each contractor provided a name and contact information for their "conservation coordinator" and the person responsible for coordinating and reporting on matters related to the overall RWMP
9.0	References	No

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### **Acronyms and Abbreviations**

1995 WQCP 1995 Water Quality Control Plan for the San Francisco Bay/

Sacramento-San Joaquin River Delta Estuary

AB 3030 Plan Assembly Bill 3030 Groundwater Management Plan

AB Assembly Bill

ac-ft acre-feet

ac-ft/yr acre-feet per year

ACID Anderson-Cottonwood Irrigation District

Ag WUE Agricultural Water Use Efficiency Element

Bay-Delta San Francisco Bay/Sacramento-San Joaquin River Delta

bgs below ground surface

BWMP Sacramento River Basinwide Water Management Plan

CALFED Bay-Delta Authority

cfs cubic feet per second

Coalition Sacramento Valley Water Quality Coalition

Cooperative Study Cooperative Water Measurement Study

CVP Central Valley Project

Delta Sacramento-San Joaquin River Delta

Department California Department of Water Resources

ESA Endangered Species Act

ET evapotranspiration

GCID Glenn-Colusa Irrigation District

ITRC Irrigation Training and Research Center

M&I municipal and industrial

maf million acre-feet

MFWC Meridian Farms Water Company

mg/L milligrams per liter

MID Maxwell Irrigation District

MRPP Monitoring and Reporting Program Plan

msl mean sea level

N/A not applicable

NCMWC Natomas Central Mutual Water Company

NRCS U.S. Department of Agriculture, Natural Resources

Conservation Service

O&M operation and maintenance

PCGID Princeton-Codora-Glenn Irrigation District

Phase 8 Settlement California Bay-Delta Phase 8 Settlement

PID Provident Irrigation District

PMWC Pelger Mutual Water Company

QO quantifiable objective

RD Reclamation District

Reclamation U.S. Bureau of Reclamation

Regional Criteria Regional Criteria for Evaluating Water Management Plans for the

Sacramento River Contractors

Regional Plan Sacramento Valley Regional Water Management Plan

SMWC Sutter Mutual Water Company

SRSC Sacramento River Settlement Contractor

SVWMP Sacramento Valley Water Management Program

SWP State Water Project

SWRCB State Water Resources Control Board

taf/yr thousand acre-feet per year

TB targeted benefit

TCCA Tehama-Colusa Canal Authority

TIDC Tisdale Irrigation and Drainage Company

TM technical memorandum

TMDL Total Maximum Daily Load

USFWS U.S. Fish and Wildlife Service

Water Board Central Valley Regional Water Quality Control Board

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#### **SECTION 1.0**

### Regional Description and Resources

Section 1.0 revisions to the RWMP are highlighted below in shaded text. An update of water pricing and water measurement device inventory included in the RWMP was completed and included in Section 2.0 of this 2009 RWMP Annual Update for each SRSC.

- 1.1 History and Sub-basin Description
- 1.2 Surface Water and Groundwater Resources
- 1.3 Typical District Facilities
- 1.4 Topography and Soils
- 1.5 Climate
- 1.6 Natural and Cultural Resources
- 1.7 Operating Rules, Regulations, and Agreements that Affect Water Availability
- 1.8 Water Measurement, Pricing, and Billing

Water measurement at the district level provides necessary information and monitoring data to make decisions and efficiently manage the water supply. Water measurement for a typical Sacramento Valley irrigation district can be considered in terms of four basic operations levels – supply, conveyance and distribution, turnout to individual fields or customers, and drainage. The methods used to measure water for these operations are driven largely by several key factors common to most of the SRSC districts. These include scheduled water delivery (as opposed to on-demand or rotation), unlined earthen canals and laterals on open-channel distribution systems, related irrigation methods within a given district, the predominance of particular crops, and the operation and maintenance (O&M) costs related to different measurement methods. There are also many local and site-specific factors that influence the choice of measurement methods, both between and within districts. The extent of water measurement, the methods used, and the level of recording and documentation vary greatly between individual SRSCs, from extensive measurement and reporting at all operational levels to only minimal measurement at key supply and distribution points.

To support a more standardized level of documentation related to current water measurement devices and approach, the participating SRSCs individually conducted an inventory of current water measurement devices used to measure flows at diversions, laterals, and, if determined to be appropriate in cooperation with Reclamation, turnouts. An agricultural measurement device inventory has been completed for each District/Company and is provided in Section 2 under the Water Measurement, Pricing, and Billing section for each SRSC.

- 1.8.1 Measurement Practices
- 1.8.2 Pricing Structures and Billing
- 1.8.2.1 Existing Pricing Structures
- 1.8.2.2 Indirect Price Signals Related to Water Use

Water pricing is only one of several direct and indirect cost signals to which a grower might be subject. For a farmer who pays a flat rate, the sum of the base charge and annual irrigation charge as referenced in Table 1-6, for water use as an SRSC customer, may still have a monetary impact through such things as quantity and cost of fertilizers, pesticides, and herbicides. Increased water use may increase costs for these inputs. Poor water management by over irrigating may reduce yields and resulting gross revenue. If the farmer operates a private well or drain pump, the electrical power costs are a direct cost related to water use. Districts must cover operating and capital expenses with revenue from customers. Excessive irrigation results in increased pumping costs from the Sacramento River, the drain system, and wells. These costs are ultimately passed directly back to the growers, albeit at an average rate for all district customers. Many SRSC operating staff have authority to shut off delivery to a customer whose field is observed to be poorly irrigated and allowed to have excessive tailwater runoff.

TABLE 1-6
Existing SRSC Pricing Structures
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SRSC	Pricing Structure
ACID	Base charge of \$69.00 per acre per year. Annual irrigation charge of \$115.00 per parcel. Irrigation delivery is on rotation basis.
GCID	Base charge of \$6.00 per acre per year. Annual irrigation charge of \$61.80 per acre (rice).
PID	Base charge of \$2.00 per acre per year. Annual irrigation charge of \$46.00 per acre (rice).
<b>PCGID</b>	Base charge of \$10.00 per acre per year. Annual irrigation charge of \$75.00 per acre (rice).
RD 108	Annual irrigation charge of \$62.00 per acre for rice. \$15.25 per irrigation (first of season) and \$8.75 per irrigation (subsequent) for other crops.
RD 1004	Per-ac-ft charge of \$9.35 per ac-ft, measured at customer turnout.
MFWC	Base charge of \$19.50 per acre per year. Annual irrigation charge of \$105.00 (rice).
SMWC	Base charge of \$25.00 per acre. Recently implemented a per acre per crop charge of \$66.00 (rice). Previously charged on a per ac-ft basis measured at customer turnout.
<b>PMWC</b>	Base charge of \$15.00 per share. Annual irrigation charge of \$15.00 to \$75.00 per acre, varies by crop.
NCMWC	Base charge and administration fee on all acres of \$43.85 and \$26.77 plus a water toll on irrigated acres based on time of crop. Irrigation charge of \$52.80 per acre (rice) and varies for other crops based on ETAW and applied water demand. Rice decomposition flooding charge of \$13.08 per acre.

Information specific to each participating SRSC's pricing structure, including the basis of the water charges and copies of current billing forms used by each, can be found in Section 2.

- 1.9 Water Shortage Allocation Policies
- 1.10 Water Quality

#### **SECTION 2.0**

# Sub-basin Water Use, Supply, and District Descriptions

<u>Section 2.0 revisions to the RWMP are highlighted below in shaded text. Revisions and updates were made by each</u> district/company. A water measurement device inventory was completed for each district/company and moved into this section from Section 1.0 of the RWMP.

#### 2.1 Redding Sub-basin

- 2.1.1 Water Supply within the Redding Sub-basin
- 2.1.2 Water Use within the Redding Sub-basin
- 2.1.3 Anderson-Cottonwood Irrigation District
- 2.1.3.1 History
- 2.1.3.2 Service Area and Distribution System

ACID's service area encompasses approximately 32,000 acres and extends south from the City of Redding within Shasta County to northern Tehama County, encompassing the City of Anderson and the Town of Cottonwood. Although ACID overlaps the service area boundaries of these water purveyors, the District does not currently provide water for M&I uses in these communities. Approximately 90 percent of ACID's customers irrigate pasture for haying or livestock; however, some orchard and other food crops are also grown. In total, ACID's service area accounts for about two-thirds of irrigated pasture in the Redding Sub-basin.

ACID invests significant amounts of money and time each year to prevent system degradation. Some of the major work completed recently to help maintain efficient operations throughout the District are as follows:

- Underwater siphon repair on Clear Creek Siphon
- Replacement of 860 feet of 24-inch-diameter pipeline below Perry's Pond
- Upgrade of two flashboard weirs with Irrigation Training and Research Center (ITRC) at California Polytechnic State University (Cal Poly) flap gates

#### 2.1.3.3 Water Supply

Surface Water. ACID holds a water right, under pre-1914 postings, to divert water from the natural flow of the Sacramento River. The ACID surface water supply entitlement is currently addressed in a contract renewed with Reclamation in 2005, Contract No. 14-06-200-3346A (Contract No. 3346A). This contract provides for an agreement between ACID and the United States on the diversion of water from the Sacramento River during the

period April 1 through October 31 of each year. This contract will remain in effect until March 31, 2045.

Contract No. 3346A provides for a maximum total of 125,000 ac-ft/yr, of which 121,000 ac-ft is considered to be Base Supply and 4,000 ac-ft is Project Supply, as shown in Table 2-3. The contract also provides that additional Project Supply can be purchased if surplus water is available.

TABLE 2-3

ACID: Settlement Contract Supply

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	Base Supply (ac-ft)	Project Supply (ac-ft)
Critical Months	44,000	4,000
Non-critical Months	77,000	0
Total Annual	121,000	4,000

The contract specifies the total quantity of water that may be diverted by ACID each month during the period April through October each year. The monthly distribution of the Base and Project Supply is shown on Figure 2-4. Figures pertaining to each district or company are presented at the end of each district or company discussion section. The monthly Base Supply ranges from a minimum of 8,000 ac-ft in April to a maximum of 22,000 ac-ft in June, July, and August. Project Supply is available during the months of July and August, with entitlements of 2,000 ac-ft in each. The contract identifies July and August as the critical months. For the critical months, the total Base Supply is 44,000 ac-ft, and the total Project Supply is 4,000 ac-ft, as shown in Table 2-3.

Settlement Contract Historical Diversions. Until the 1990s, ACID historically used between 121,000 to 158,100 ac-ft of their Base and Project entitlements, as shown on Figure 2-5. In recent years, ACID's ability to divert their entitlement was reduced because of fishery limitations associated with the District's operation and management of its distribution facilities. In response to a pending lawsuit by NOAA Fisheries in 1992, ACID reduced the quantity of water circulating in their delivery system. Previously, ACID had maintained higher water levels within its distribution system that corresponded to larger diversions from the Sacramento River but also maintained large return flows from the conveyance facilities back to the Sacramento River. In addition, 4 years (1977, 1991, 1992, and 1994) were classified as "critical years" and contract supplies were reduced to 75 percent or 131,250 ac-ft. During this period, ACID diverted between 96,500 and 125,800 ac-ft of their surface water entitlement. ACID, in 1999, completed the improvements to the fish ladder and screen facilities at their seasonal dam near Redding. These improvements provide greater flexibility in diverting their contract entitlements but are not expected to affect diversion quantities.

Figure 2-4 shows the historical monthly average diversions for the following five periods:

 1977 to 1991: Long-term period of record from beginning of recording period to just before the listing of winter-run Chinook salmon as an endangered species (also NOAA Fisheries lawsuit filed) in 1992

- 2. 1979 to 1982: A period of near-normal hydrologic and water use conditions
- 3. 1992 to 1996: The period following the listing of the winter-run Chinook salmon (also NOAA Fisheries lawsuit filed) to present
- 4. 1997 to 2005: The period through expiration of the original Settlement Contract
- 5. 2006-2007: The period to date under the renewed Settlement Contract, under which both the total contract supply and monthly diversion schedule have been revised (see Table 2-3A)

TABLE 2-3A
Diversions and Irrigated Acres – ACID 1997–2007
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Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Total	Irrigated Acres
1997	10,496	22,914	19,441	20,674	20,697	17,556	4,796	116,574	7,111
1998	1,309	15,020	17,885	20,200	20,365	18,322	7,569	100,670	7,118
1999	10,256	19,301	18,344	20,204	20,108	17,273	7,146	112,632	7,156
2000	11,611	18,563	18,936	18,652	19,341	18,529	12,723	118,355	7,131
2001	4,760	22,530	19,767	20,512	21,702	18,657	14,124	122,052	7,060
2002	6,829	18,955	19,427	21,483	20,813	18,382	7,448	113,337	7,046
2003	6,184	14,829	19,488	18,866	18,330	17,583	12,472	107,752	6,972
2004	10,975	19,704	18,392	19,638	17,119	15,971	11,770	113,569	6,974
2005	6,166	11,356	17,219	19,337	18,857	16,265	12,818	102,018	6,779
2006	0	15,601	16,855	16,446	17,517	15,541	11,208	93,168	6,617
2007	16,613	17,692	17,677	18,228	18,203	17,768	5,722	111,903	6,644
Avg.	7,745	17,860	18,494	19,476	19,368	17,441	9,800	110,185	
Under renewed Settlement Contract, new monthly diversion schedule:									
Project				2,000	2,000			4,000	
Base	8,000	10,000	22,000	22,000	22,000	19,000	18,000	121,000	

The following observations are noted:

- The average monthly diversions of Sacramento River water by ACID reflect the pattern of monthly quantities specified in the contract entitlements.
- With the exception of April, the average monthly diversions (1977 to 1991) are within 5,000 ac-ft of the total contract entitlement. However, diversions in April (1977 to 1991) average less than 10,000 ac-ft in comparison to the monthly contract entitlement of 21,000 ac-ft. Diversions in the month of April are greatly affected by late-spring precipitation.
- Since 1991, total annual diversions have decreased and, thus, average diversions during each respective month have also decreased.

- Every year between 1977 and 1991, ACID had diverted some portion of their Project Supply.
- Since 1991, ACID has only diverted Project Supply during critically dry years (see also Figure 2-5). Reductions in Project Supply diversions relates to the increased cost of that associated with CVPIA Restoration Fees assessed on diverted Project Supply.

Non-contract Period (November - March).

Other Surface Water Sources.

Groundwater.

Other Water Supplies.

#### 2.1.3.4 Water Use

**District Water Requirements.** 

**Urban**. ACID's service area overlays several municipal water purveyors, but the District currently does not provide Base Supply water to any major M&I users. Many of these users are projecting increased demands to the year 2030. The Department estimates growth in the M&I sector in the vicinity of ACID to result in an increased annual water requirement of approximately 30,000 ac-ft by the year 2020, which would represent an increase of about 75 percent (Department, Northern District). A majority of the increase is assumed to be met by surface water taken from the Sacramento River. The District has implemented some programs and is actively negotiating others that would increase supply to these purveyors.

Examples of programs include direct supply to water treatment facilities, direct supply for municipal irrigation, provision of water for cooling buildings and industrial developments, water marketing, and assisting with the fulfillment of area of origin needs. The District has implemented the following two long-term water transfer agreements (2006 and 2008) for the provision of Project water for general municipal and industrial use:

- City of Shasta Lake: Transfer of 2,000 ac-ft/yr of Project water through 2045. This
  transfer has been conditionally approved by Reclamation after the determination that no
  more than 140 ac-ft/yr, pursuant to this project, may be diverted out of Lake Shasta
  except in above-normal or wet water-year types to avoid impacts to the lake's coldwater pool.
- Shasta Community Services District: Transfer of 464 ac-ft/yr of Project water through 2045. This transfer has been approved and will result in additional diversions by Shasta Community Services District from Whiskeytown Lake for general M&I purposes within its service area.

The District is currently providing Anderson Union High School water for cooling operations.

The District is currently proposing and negotiating the following two projects that are likely to be implemented:

• City of Redding: An agreement that would introduce the city as a customer of ACID to facilitate the provision of Base Supply for M&I purposes to overlaps in the service areas. Future needs that may be met by this agreement are projected to be 4,000 ac-ft/yr.

• Bella Vista Water District: An agreement for the long-term transfer (through 2045) of 1,536 ac-ft of Project water is imminent.

In addition to these realized and potential M&I demands, the District is currently participating in the Shasta County Water Resources Master Plan, which is assessing needs to the year 2030.

Environmental.

Groundwater Recharge.

Topography and Soils.

Transfers and Exchanges. The ACID is one of 34 SRSCs that currently participate in the Pool Program. Since 1974 the Pool Program has been the forum to move available Project Supply water in certain years to other SRSCs. Each year, members participating in the Pool Program have the option to identify a quantity of their respective Project Supply that they wish to make available to the Pool Program rather than for diversion. Past water transfers from ACID to the Sacramento River Water Contracting Association are shown in Table 2-4.

ACID has participated marginally in the Pool in recent years. In 2008, all of ACID's Project water was transferred under long-term and individual spot-market agreements. Of the 4,000 ac-ft of 2008 Project water, 490 ac-ft was transferred pursuant to existing long-term agreements; and the remaining 3,510 ac-ft was transferred on a 1-year basis to downstream agricultural Project contractors.

If the Water Transfer Agreement now being negotiated with Bella Vista Water District is executed, and Reclamation approval is obtained, all of ACID's Project Supply will be committed for transfer to local purveyors each year through 2045.

Other Uses.

- 2.1.3.5 District Facilities
- 2.1.3.6 ACID Operating Rules and Regulations
- 2.1.3.7 Water Measurement, Pricing, and Billing

ACID's main river diversions (Lake Redding and Churn Creek) have meters installed and operated by Reclamation, which provide both flow rate and total volume of flow. At major lateral headgates, the District measures flow rates manually using weir or gate head-flow tables. Flows at field turnouts are measured using canal headgate position tables. Drain pump flows are not metered, but the total volume pumped is estimated using power consumption and pump efficiency history. Increases in conveyance efficiency may be achieved with a program of water measurement that includes installation of intermediate measurement points along the Main Canal, improved lateral flow measurement, and installation of flowmeters and totalizers on drain pumps.

ACID does not currently meter individual customer turnouts. Estimates of flow rate are made based on canal headgate position relationships that were established by a one-time measurement of customer turnout flows using weir flow tables or a handheld propeller meter. Total deliveries per customer are not recorded. ACID's on-farm efficiency is relatively low (45 percent based on 1982 NRCS study). Field metering in combination with

modifying the delivery arrangement from a rotation basis to arranged, an appropriate incentive pricing structure, and on-field improvements such as land leveling may increase the average on-farm efficiency, with some savings in water use. However, the effective implementation of such a program would depend on the correct combination of the above factors, in addition to basic economic considerations such as the return on investment to the District and landowners. Additionally, the installation, maintenance, and reading of the meters (950) would represent a major up-front capital cost to the District as well as an ongoing labor and capital expense. Table 2-7A presents an inventory of the District's water measurement devices.

TABLE 2-7A
Agricultural Measurement Device Inventory for ACID
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Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Propeller	1	+/-2%	Daily	Yearly	Yearly
Sonic Flowmeters	1	+/-2%	Daily	Yearly	Yearly
Weirs	20	+/-10%	Weekly	NA	Yearly
USGS Stage Recorder	1	+/-5%	Daily	Monthly	Yearly
SCADA Pressure Transducers	4	+/-1%	Twice daily	Yearly	Yearly
IRTC Mobile Weir Stick	1	+/-10%	Approximately every other month	NA	NA
Mobile Global Flow Probe	2	+/-5%	As needed	Yearly	Yearly
Total	32				

Note:

NA = not applicable

ACID customers pay on a per-acre basis of irrigated land, and are billed upon submittal of an application for water each spring prior to the irrigation season. An administrative application fee of \$115 per parcel is also imposed.

Rates from 2003 through 2008 remained unchanged at \$69 per irrigated acre. Although not formally adopted, the ACID Board of Directors has proposed a rate increase to \$75 per acre for 2009. The proposed rate will be considered during budget development, and a final decision will be reached in December 2008.

#### 2.2 Colusa Sub-basin

- 2.2.1 Water Supply within the Colusa Sub-basin
- 2.2.2 Water Use within the Colusa Sub-basin

#### 2.2.3 Glenn-Colusa Irrigation District

#### 2.2.3.1 History

GCID (or the District) has a water right, under pre-1914 postings, to divert water from the natural flow of the Sacramento River. The water right dates back to 1883, when Will S. Green posted notices for the appropriation and diversion of irrigation water on the west bank of the Sacramento River, at the upstream end of the Oxbow Channel near the current diversion at the main pump station. GCID also has adjudicated pre-1914 water rights under the Angle Decree, issued in 1930 by the Federal District Court, Northern District of California, to divert water from the natural flow of Stony Creek, a tributary to the Sacramento River.

GCID entered into a negotiated agreement with Reclamation in 1964, quantifying the amount of water GCID could divert from the Sacramento River. The resulting negotiated agreement recognized GCID's annual entitlement of a Base Supply of 720,000 ac-ft/yr of flows from the Sacramento River and also provided for a 105,000 ac-ft allocation of Project Supply, resulting in a total contract entitlement of 825,000 ac-ft/yr. The 825,000 ac-ft/yr entitlement recognized under contract for GCID is inclusive of their entitlement recognized under their Angle Decree rights, which, on average, yield about 15,000 to 18,000 ac-ft/yr. The schedule of monthly diversions of the Contract Total, Base Supply, and Project Supply are identified in Table 2-9 to the Settlement Contract.

#### 2.2.3.2 Service Area and Distribution System

#### 2.2.3.3 Water Supply

Surface Water. GCID holds both pre- and post-1914 appropriative water rights to divert water from the natural flow of the Sacramento River. GCID also has adjudicated pre-1914 water rights under the Angle Decree, issued in 1930 by the Federal District Court, Northern District of California, to divert water from the natural flow of Stony Creek, a tributary to the Sacramento River. In addition, as the successor in interest to Central Canal and Irrigation Company, GCID may have, under a May 9, 1906 Act of Congress, "the right to divert, at all seasons of the year, from the Sacramento River...an amount of water which...shall not exceed nine hundred cubic feet per second, to be used for irrigating the lands of the Sacramento Valley, on the west side of the Sacramento River" (Public Law 151, Ch. 439). These water rights are shown in Table 2-10 with associated dates and quantities.

The GCID surface water supply entitlement is currently addressed in a contract entered into with Reclamation in 1964, Contract No. 14-06-200-0855A (Contract No. 0855A). This contract provides for an agreement between GCID and the United States on the diversion of water from both the Sacramento River and Stony Creek from April 1 through October 31 of each year. This contract has been renewed and will remain in effect from April 1, 2005 through March 31, 2045.

Pursuant to provisions of the contract, Reclamation can require GCID to divert from the Sacramento River water quantities equal to and in lieu of its entitlement under the Angle Decree. Such water, along with Sacramento River water, is made available to GCID under Contract No. 0855A for diversion at its main pump station. In 1998, GCID executed a new agreement with Reclamation (Agreement No. 1425-98-FC-20-17620) for the conveyance of

wildlife refuge water and other related purposes. Under the terms of this separate wheeling agreement with Reclamation, GCID can request to receive a portion of its entitlement water via two points on interconnections with the Tehama-Colusa Canal: the Cross-Tie, a 48-inch diameter pipe at Canal Mile 56, and the Inter-Tie, a 1,000-cfs flume, at Canal Mile 37. The use of the Tehama-Colusa Canal for delivery of entitlement water is subject to available capacity as determined by Reclamation, in accordance with the terms and conditions of the wheeling agreement. However, GCID has agreed to pay TCCA the O&M costs associated with wheeling a minimum of 20,000 ac-ft annually of Sacramento River water to GCID from the TC Canal whether GCID uses the water or not. This water is typically acquired during rice season flood up after May 15 when the gates are put in at the Red Bluff Diversion Dam.

Contract No. 0855A provides for a maximum total of 825,000 ac-ft/yr, of which 720,000 ac-ft is considered to be Base Supply and 105,000 ac-ft is CVP water (Project Supply). The contract also provides that additional Project Supply can be purchased if surplus water is available. Water from Stony Creek and water diverted from the Sacramento River at the main pump station is accounted for as water diverted under Contract No. 0855A. For purposes of the contract, it was determined that GCID's Angle Decree rights yielded, on a long-term average, about 15,000 ac-ft/yr. This yield was included in the 720,000 ac-ft of Base Supply entitlement recognized under Contract No. 855A.

The contract specifies the total quantity of water that may be diverted each month during the period April through October each year. The monthly Base Supply ranges from a minimum of 45,000 ac-ft in October to a maximum of 150,000 ac-ft in June. CVP Supply water is available during the months of July and August, with entitlements of 55,000 and 50,000 ac-ft, respectively. The contract identifies July and August as the critical months. For the critical months, the total Base Supply is 220,000 ac-ft and the total Project Supply is 105,000 ac-ft, as shown in Table 2-11. The monthly distribution of the Base and Project Supply is shown on Figure 2-11.

#### Settlement Contract Historical Diversions.

Non-contract Period (November – March). Contract No. 0855A does not limit GCID from diverting water for beneficial use during the months of November through March, to the extent authorized under California law. GCID has recently obtained a water right permit for non-contract-period diversions in the amount of 182,900 ac-ft (up to 1,200 cfs), as shown in Table 2-10. Although some pre-irrigation occurs within the District, non-contract-period diversions are predominantly used for rice straw decomposition and waterfowl habitat. In response to increasingly stringent limitations on rice burning, many of the District's landowners flood a portion of their fields to clear their land of leftover rice straw by allowing the rice stubble to decompose. Approximately 54,000 acres were flooded in 2004 with expectation that this acreage number will increase in the future.

GCID has an agreement with Reclamation to convey water to approximately 22,500 acres of wildlife refuges year-round. GCID is strictly a water conveyor for Reclamation in this agreement and is paid on an ac-ft basis. The water delivered to the refuges by GCID is not counted toward GCID's water right entitlement. Approximately, 60,000 to 80,000 ac-ft/yr of supply is conveyed by GCID to the refuges. However, the District must be prepared, if necessary, to convey up to 105,000 ac-ft to meet Level 4 requirements. In addition, as noted above, GCID may hold a right to divert up to 900 cfs from the Sacramento River during "all

### seasons of the year," pursuant to the May 9, 1906 Act of Congress (Pub. L. No. 151, Ch. 2439).

As discussed above, GCID has entitlements to water from Stony Creek, which can be diverted from Stony Creek, or equivalent quantities can be diverted from the Sacramento River. The GCID service area is relatively large and contains a number of small tributaries to the Sacramento River. GCID holds water rights to pump from Hunters Creek, Funks Creek, and Colusa Basin Drain, as shown in Table 2-10.

Groundwater. The GCID boundary lies within the Sacramento Groundwater Basin. The area is located on alluvium and flood basin sediments, as well as alluvial fan deposits. Flood basin sediments are deposited in low-energy environments; therefore, they typically exhibit low permeabilities. Alluvial fan sediments are deposited in higher energy, continental environments. Because they are coarser grained, alluvial fan deposits generally have high permeabilities. These recent sediments are underlain by older deposits of the Tehama and Tuscan Formations (Department, 1978).

In the northern portion of GCID, the Tehama Formation contains extensive deposits of interbedded gravel from the ancestral Stony Creek (the Stony Creek Member). The Stony Creek Member of the Tehama Formation is typically very productive, yielding large quantities of water to wells. In the south-central portion of GCID, between Willows and Williams, the Tehama Formation is predominately clayey, and wells in this area are generally less productive than those in the northern portion of GCID (Department, 1978).

The Tuscan Formation is an important water-bearing unit in the northeastern portion of the Sacramento Valley (Department, 2003a). In the Colusa Sub-basin, the Tuscan Formation interfingers with the Tehama Formation at depths of 300 to 1,000 feet bgs. Coarse-grained deposits within the Tuscan Formation can provide high well yields; however, the unit is generally too deep to be tapped by domestic and most agricultural wells west of Chico (Department, 1978).

Groundwater quality in the Sacramento Groundwater Basin is generally good and is sufficient for agricultural, domestic, and M&I uses. The total depth of freshwater aquifer in the GCID area is estimated as 900 to 1,500 feet bgs. The freshwater is underlain by saline water found in older marine units

In the northern portion of GCID, between the towns of Artois and Glenn, groundwater movement is generally to the southeast, toward the Sacramento River, at a gradient of between 4 and 15 feet per mile (Department, 2003a). In the middle of GCID, near the Town of Maxwell, the flow changes to a more easterly direction with a gradient of approximately 4 to 10 feet per mile. At the southern end of GCID, near the town of Williams, groundwater flows east to slightly northeast, toward the Sacramento River, with the gradient ranging from 7 to 10 feet per mile. The steeper gradients exist at the southwest and northwest edges of GCID. Groundwater throughout the Sacramento Groundwater Basin, and therefore within GCID, occurs in a broad alluvial basin and is therefore not confined to any well-defined subsurface stream channels.

Groundwater use within GCID is generally limited because of the availability of surface water supplies and is driven primarily by climatic conditions. GCID manages and operates a voluntary groundwater conjunctive water management program to increase capacity

when water supply does not meet demand. Up to 100 landowners have participated in the groundwater program, representing a combined capacity of approximately 500 cfs. Pumping ranges from 20,000 ac-ft/year during years of high surface water supply to as much as 77,000 ac-ft in critically dry years. Seasonal fluctuations in groundwater levels are generally less than 10 feet, but can be up to 30 feet in drought years. Historical trends show that groundwater levels in the GCID area are generally stable over the long term, although short-term fluctuations in groundwater levels are observed that can be correlated with precipitation trends. GCID implemented a conjunctive water management project pilot study where up to 65,000 ac-ft of groundwater was pumped from private wells during the 1994 irrigation season.

Other Water Supplies. An aggressive recapture program, which captures both subsurface flows (from system leakage and deep percolation recovered by open surface drains) and tailwater runoff from cultivated fields from within GCID's service area, is a part of GCID's overall water management program. GCID recaptures this water with both gravity and pump systems. This captured water is delivered to either laterals or the main canal for reuse. Currently, GCID recycles approximately 155,000 ac-ft annually. Relatively small quantities of tailwater are available to GCID from areas outside of the District's boundaries.

Continued reuse and recycling efforts are expected to be influenced by an increasing need to manage salinity and other constituents that affect crop productivity and sustainability. The District has established a program that encompasses the entire District to monitor soil and water salinity and test for electrical conductivity and pH.

Much of GCID's surplus water is captured for use by downstream districts such as the PID, PCGID, and MID. GCID is one of the irrigation districts that signed the Five-Party Agreement of June 2, 1956. This agreement represents a cooperative effort by GCID, PID, PCGID, MID, and two entities that have since dissolved (Compton-Delevan Irrigation District and Jacinto Irrigation District) to share O&M of the drains within their respective service areas and to share the right to recirculate the water in those drains. In addition, Colusa Basin Drain Mutual Water Company members (57,000 acres, gross) rely on tailwater from GCID and other upstream water users.

GCID adopted a Water Transfer Policy in 1995. This policy identifies agricultural water users within the Sacramento Valley as the highest priority, and environmental purposes as the second highest priority for future water transfers. An in-basin water transfer program was introduced in 1997 that provides for up to 20,000 ac-ft to be transferred to neighboring lands in full water supply years.

#### 2.2.3.4 Water Use

District Water Requirements. Land use within GCID's service area is primarily rice, due to the presence of fine-textured and poorly drained soils within the majority of the District. Other key crops include alfalfa, tomatoes, and cotton. Rice accounts for approximately 80 to 85 percent of the District's irrigated acreage on an annual basis (Department, Northern District). Water requirements are typically highest during the summer months (July and August) due to the requirements of rice and the area's hot, dry climate. Cultural practice water needs for rice are greatest early in the growing season associated with the flooding up of previously dry rice fields. Although surface water is the primary source of irrigation

water, groundwater is used in drought years on an individual grower basis, as well as per agreements with the District.

Annual cropping patterns have remained fairly constant over the last few decades, other than in response to farm programs in the early 1980s. Associated water requirement needs and associated diversions have therefore been more a function of water-year type and climate than changes in cropping.

Figure 2-14 summarizes irrigated acreage by crop, on-field water requirements, and TDRs.

Table 2-12 shows current (1995 normalized estimates) irrigated acreage estimates for the primary crops grown within the District service area, as well as projections for 2020. The variation around these estimates (± percentage figures) was provided by the District to account for typical variations in particular crop acreage (primarily due to year type), as well as anticipated future variation.

In response to increasingly stringent limitations on burning, many of the District's land-owners flood a portion of their fields to clear their land of leftover rice straw by allowing the rice stubble to decompose. GCID estimates that approximately 54,000 acres were flooded in 2004, a trend that is expected to continue or increase, assuming other options (including the sale of stubble for ethanol production) are not determined to be more economically feasible.

TABLE 2-12
GCID Irrigated Acreage – 1995 and 2020 Estimates
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Crop	1995 <sup>a</sup>	2020 <sup>b</sup>
Rice	99,300 (± 10%) <sup>c</sup>	99,100 (± 10%)°
Grain	5,500 (± 10%)°	5,000 (± 10%)°
Alfalfa	4,300 (± 50%)°	4,500 (± 50%)°
Pasture	4,100 (± 20%) <sup>c</sup>	3,300 (± 20%)°
Tomatoes	$3,800 (\pm 40\%)^{c}$	$6,400 (\pm 40\%)^{c}$
Other Crops	13,200 (± 10%) <sup>c</sup>	18,500 (± 10%) <sup>c</sup>
Total Irrigated Acreage	130,200 (± 10%) <sup>c,d</sup>	136,800 (± 10%) <sup>c,d</sup>

<sup>a</sup>Values are estimates derived from field data that have been normalized (data has been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: Department, Northern District.

<sup>b</sup>Values are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: Department, Northern District.

<sup>c</sup>Percentages obtained from GCID.

<sup>d</sup>Includes approximately 2,000 acres on average of double cropped acres.

This practice provides additional winter habitat for waterfowl above that which has been available within the Sacramento Valley since the development of agriculture.

Future irrigation-season cropping patterns and associated water requirements are anticipated to remain relatively the same as current conditions.

Urban.

Environmental.

Groundwater Recharge.

Topography and Soils.

Transfers and Exchanges.

Other Uses.

District Facilities. GCID's main facilities within its service area include a 3,000-cfs pumping plant and fish screen structure, a 65-mile main canal, and approximately 900 miles of lateral canals and drains that serve its approximately 175,000-acre service area (Figure 2-15). The pump station is situated on an oxbow off the main stem of the Sacramento River. Diversion flow passes through a 1,100-ft fish screen structure where it is pumped into GCID's main irrigation canal. The remaining flow in the oxbow passes by the screens and then back into the main stem of the Sacramento River. The construction of a large siphon at Stony Creek in 1998, and various other siphons and cross-drainage structures in 1999/2000, has eliminated the need for a seasonal dam in Stony Creek and allows for winter deliveries.

#### **Diversion Facilities.**

Conveyance System. GCID has approximately 65 miles of main canal and 900 miles of laterals canals and drains. The main canal is the primary conveyance facility for the District. The main canal generally runs along the west side of the District and supplies the various laterals for delivery to field turnouts. GCID has made many major main canal improvements during the past 10 years and will continue to modernize facilities to accommodate its canal SCADA and automation projects. These include the installation of new cross-drainage structures and the replacement of existing drainage and control structures. These improvements allow year-round operation of the main canal for supplying the wildlife refuge complex lands.

Table 2-14 summarizes GCID's main canal and irrigation lateral features. GCID does not currently have any lined canals. Estimation of the leakage losses from the GCID main canal indicates that losses are minimal due to the low permeability of the clay soils that are common in the area. A relatively minor quantity of water could be saved by lining some portion of the main canal, but the preliminary analysis shows this to be a prohibitively expensive water management option. Most seepage from District canals returns to surface drains adjacent to the canals, or recharges the underlying groundwater basin, making net regional water savings from canal lining minimal.

GCID has been modernizing its facilities to create a canal system with automated control and monitoring, including motor-operated radial and slide gates, water-level and flow measurement at key points in the system, and integrated SCADA to match supplies and demands throughout the system. The District also has an ongoing program to increase the coverage of the SCADA system and to automate remaining major flow control structures. Only five major control structures on the main canal require replacement and modernization. The District's operational spills are minimal based on the standard performance and requirements of an open-channel distribution systems, and it is not likely that significant reductions in the quantity of operational spills can be achieved.

TABLE 2-14
GCID Canals and Laterals
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Facility Name	Source Facility	Capacity (cfs)	Lined	End Spill Location	Percent Leakage Loss Estimate
GCID Main Canal	Hamilton City Pump Station	3,000	No	NA .	13
River Branch Canal (Lateral 12-4)	GCID Main Canal at MCM 12.8/12.9	200	No	Lower part of PCGID	15
Bondurant Slough (Drain A) (Laterals 17-1 and 17-2)	GCID Main Canal (48-inch Sluice Gate)	200	No	Colusa Basin Drain	12
Quint Canal (Lateral 21-2)	GCID Main Canal	100	No	Colusa Basin Drain (2047 Drain)	12
Willow Creek (Drain B)	GCID Main Canal	100	No	Quint Canal	12
Lateral 25-1	GCID Main Canal	50	No	Western Canal	12
Lateral 26-2	GCID Main Canal	130	No	Sacramento National Wildlife Refuge	10
Lateral 35-1	GCID Main Canal	30	No	Sacramento National Wildlife Refuge	10
Hunter Creek (Drain D) (aka Willits Slough)	GCID Main Canal (Sluice Gate at MCM 40.3)	75	No	Logan Creek and Colusa Basin Drain, MID	10 (clay)
Lateral 41-1	GCID Main Canal	80	No	Delevan National Wildlife Refuge, MID	10 (clay)
Stone Corral Creek (Drain E)	GCID Main Canal	50	No	Delevan, Maxwell, and Colusa Basin Drain	<10
Lateral 45-1 (Drain F3 System)	GCID Main Canal	43	No	Kuhl Weir-MID	11
Lateral 48-1 (Lurline Creek System)	GCID Main Canal	100 (Lurline Creek)	No	CDMWC and MID	12
Lateral 49-2 (Lurline Creek System)	GCID Main Canal	100 (Lurline Creek)	No	CDMWC and MID	12
Lateral 51-1 (Freshwater Creek System	GCID Main Canal	50	No	CDMWC Colusa Drain	12
Salt Creek System (including Spring Creek)	GCID Main Canal	50	No	Joins Freshwater Creek and goes into Colusa Drain (Davis Weir)	10 (can gain water)
Lateral 64-1 (at M.P. 64.95)	GCID Main Canal	80	No	Colusa National Wildlife Refuge	10
Lateral 56-1	Tehama-Colusa Canal Crosstie	130	No	Spring Creek/Salt Creek System	10

Note:

CDMWC = Colusa Drain Mutual Water Company

Storage Facilities. GCID currently has no significant storage facilities. The Department is currently studying the feasibility of constructing the Sites Reservoir west of the Town of Maxwell. There is potential benefit to the reintroduction of water from Sites Reservoir, through the District's Main Canal, to the Colusa Basin Drain and then to the Sacramento River. For example the water from Sites Reservoir could be blended with drain flow from the District to improve water quality released to the downstream system.

The Stony Creek Fan Partnership, a partnership between GCID and its neighbors, Orland Unit Water Users Association, and Orland-Artois Water District, is funded through the Integrated Storage Investigations Program to examine the potential for groundwater production and recharge within a gravely strata located in Glenn County, the Stony Creek Fan. GCID's Conjunctive Use Program is being developed in conjunction with the Stony Creek Fan Program and builds upon data obtained through this investigation and the Sacramento Valley Water Management Program.

Spill Recovery. An aggressive recapture program, which includes groundwater seepage and tailwater runoff from cultivated fields, is part of the District's overall water management program. GCID has a network of unlined drainage ditches for conveying irrigation return flows and regional surface runoff. The drainage ditches generally empty into regional sloughs and creeks, which in turn drain into the Colusa Basin Drain. The District operates 19 drain recapture pump stations to divert for reuse. These pump stations have a total combined capacity of 912 cfs, and recapture an average of 76,000 ac-ft/season. The District also has 18 gravity surface diversions for recapturing, which recapture an average of 77,000 ac-ft/season.

#### 2.2.3.5 District Operating Rules and Regulations

GCID was formed under Division 11 of the California Water Code. As such, the District is subject to the rules and regulations of this code including governing its actions through an elected Board of Directors and is required to keep a minimum amount in financial reserves.

Water rotation, apportionment, and shortage allocation:

According to Rule 13 of GCID Rules and Regulations: *All consumer requests for water must be received at the District's office, or by the responsible water operations worker, at least three days before the water is needed by the consumer.* 

According to Rule 14 of GCID Rules and Regulations: In the event of water shortage or water delivery constraints, the District will endeavor to equitably apportion the available District water to the District land entitled thereto.

In years in which the Board concludes that the District's water supply will be inadequate to serve all lands entitled to service from the District, the District will estimate the total water supply available for the irrigation season, and after deducting estimated canal losses, apportion the balance to each District landowner in accordance with California Water Code section 22250 and 22251. To accomplish this apportionment, the District will accept primary applications for acreages of crops for which the landowner's apportioned water share will bring appurtenant crops to maturity. All additional acreage applied for will be placed on a secondary application list. On expiration of the time to submit primary water applications, if the total estimated water required to serve the primary application is less than the total

estimated water available, the excess shall be equitably allocated to secondary applications at the discretion of the Board.

#### Use of drainage waters:

According to Rule 14 of GCID Rules and Regulations: District landowner(s) are advised that drain water in the District is considered water supplied by the District, and any such water recaptured by the landowner(s) or user(s) may not be used to increase irrigated acreage.

#### Policies for wasteful use of water:

According to Rule 16 of GCID Rules and Regulations: If, in the opinion of the General Manager, a consumer is wasting water, either willfully, carelessly, negligently or on account of defective private conduits, the District may refuse the delivery of water until the wasteful conditions are remedied, or the District may reduce the water inflow into the consumer's fields to a flow that would be reasonable if such wasteful conditions were remedied. Wasteful water use practices include, but are not limited to, (1) using water on roads, vacant land, or land previously irrigated, (2) flooding any portions of a consumer's land to an unreasonable depth or using an unreasonable amount of water in order to irrigate other portions of such land, (3) using water on land that has been improperly prepared for the economical use of water, and (4) allowing an unnecessary amount of water to escape from any tailgate.

The District reserves the right to refuse delivery of water when, in the opinion of the District Manager, the proposed use, or method of use, will require excessive quantities of water which constitute waste.

#### 2.2.3.6 Water Measurement, Pricing, and Billing

Main canal flows are measured using meters at key points, including a new acoustic measuring device at the recently constructed Stony Creek siphon. Main laterals and sublaterals that serve field turnouts are metered. The District drain pumps and groundwater wells are metered. Turnouts to fields are measured and totalized by service area using the measurements for the service lateral that serves each area. Lateral spills are measured and totalized using lateral stage measurement and weir equations. Drain outflows from the District are measured and recorded using a combination of weirs and meters.

GCID does not currently meter individual field turnouts, with the exception of several test plots that are used to provide detailed quantitative data for use in monitoring efforts to improve farm-level water management. GCID does, however, measure flow rates at turnouts using canal stage and head-discharge relationships for orifices and gates. Total deliveries per service lateral are recorded. The average on-farm efficiency for the District is approximately 65 percent, which is near the practical upper limit of around 70 percent. Farm-level measuring in combination with incentive pricing and on-farm improvements may potentially increase the average on-farm efficiency and provide a quantity of conserved water. Table 2-14A presents an inventory of the District's water measurement devices.

TABLE 2-14A
Agricultural Measurement Device Inventory for GCID

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Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Orifices	0	+/- %	NA	NA	NA
Propeller	40	+/-4%	Daily	Yearly	Yearly
Weirs	116	+/-5%	Daily	NA	Every 5 years
Flumes	2	+/-2%	Daily	Every 5 years	Every 5 years
Venturi	1	+/-2%	Daily	Every 5 years	Every 5 years
Metered Gates	25	+/-5%	Daily	Every 10 years	Every 10 years
Total	184				

GCID also participates in an effort to support improved water management in the Sacramento Valley on a broader scale, the *Sub-basin-level Water Measurement Study* was proposed by the SRSCs and subsequently funded through CALFED. Given the BWMP's recommendation that sub-basin management be further explored, this water measurement study focuses on increasing the water measurement level of accuracy at a sub-basin level. This ongoing study is a preliminary investigation of potential measurement locations, facilities, and associated implementation issues to allow for water measurement in the five Sacramento Valley sub-basins addressed in the BWMP.

#### 2.2.4 Provident Irrigation District

#### 2.2.4.1 History

PID (or the District) was formed on April 27, 1918. A small part of the land in what is now PID was once within the old Central Irrigation District. In 1931, when PID was reorganized and refinanced, certain lands were excluded. Some of the lands that were excluded were later organized into the Willow Creek Mutual Water Company. In 1964, PID and Reclamation entered into a negotiated agreement quantifying the amount of water PID could divert from the Sacramento River. The negotiated agreement recognized PID's annual entitlement to a Base Supply of 49,730 ac-ft/yr from the Sacramento River and also provided for a 5,000 ac-ft allocation of Project Supply, resulting in a total contract entitlement for 54,730 ac-ft/yr. The schedule of monthly diversions of the Contract Total, Base Supply, and Project Supply are identified in Exhibit A for PID is included in Table 2-15. The Settlement Contract negotiated in 1964 remained in effect until March 2006. PID has worked with Reclamation and counsel to finalize environmental documentation for contract renewal for a new 40-year contract with 49,730 ac-ft of Base Supply and 5,000 ac-ft of Project Supply.

#### 2.2.4.2 Service Area and Distribution System

#### 2.2.4.3 Water Supply

Surface Water. PID holds water rights to divert water from the natural flow of the Sacramento River. The PID surface water supply entitlement was addressed in a contract entered into with Reclamation in 1964, Contract No. 14-16-200-0856A (Contract No. 0856A).

This contract provides for an agreement between PID and the United States on PID's diversion of water from the Sacramento River during the period April 1 through October 31 of each year. This contract expired March 31, 2004. Congress granted a 2-year extension; therefore, the contract remained in effect until March 31, 2006. PID worked with Reclamation and counsel to finalize environmental documentation for the new contract renewal, which took effect for another 40 years at the end of the 2-year extension. Contract No. 0856A provides for a maximum total of 54,730 ac-ft/yr, of which 49,730 ac-ft is considered to be Base Supply and 5,000 ac-ft is CVP water (Project Supply), as shown in Table 2-17. The contract also provides that additional Project Supply can be purchased if surplus water is available.

The contract specifies the total quantity of water that may be diverted by PID each month during the period April through October each year. The monthly distribution of the Base Supply and Project Supply is shown on Figure 2-16. The monthly Base Supply ranges from a minimum of 2,500 ac-ft in August to a maximum of 12,920 ac-ft in June. CVP water (Project Supply) is available during the months of July, August, and September with entitlements of 3,500, 1,000, and 500 ac-ft, respectively. The contract identifies July, August, and September as the critical months. For the critical months, the total Base Supply is 16,200 ac-ft, and the total Project Supply is 5,000 ac-ft, as shown in Table 2-17.

#### Settlement Contract Historical Diversions.

Non-contract Period (November – March). Contract No. 0856A does not limit PID from diverting water for beneficial use during the months of November through March, to the extent authorized under California law. PID has filed for, and was granted, a water right permit for non-contract-period diversions in the amount of approximately 26,700 ac-ft, as shown in Table 2-16. Relatively little pre-irrigation occurs within the District, and therefore, non-contract-period diversions are predominantly used for rice straw decomposition. In response to increasingly stringent limitations on burning, many of the District's landowners flood a portion of their fields to clear their land of leftover rice straw by allowing the rice stubble to decompose. Approximately 4,000 to 8,000 acres have been flooded in the past; however, acreage is expected to increase over the next few years.

Other Surface Water Sources.

Groundwater.

Other Water Supplies.

Water Use.

**District Water Requirements.** 

Urban.

Environmental. Approximately 50 acres of riparian vegetation are estimated to be incidentally supplied by irrigation, including vegetation directly adjacent to delivery laterals or influenced by leakage from the delivery system. Such vegetation includes habitat used by the federally listed giant garter snake. PID can contribute varying levels of flow depending on year type to the Delevan National Wildlife Refuge through Willow Creek during the irrigation season. The flooding of rice fields in the spring and summer provides wetlands

habitat during these periods for waterfowl and terrestrial species. Rice fields that are not flooded also provide habitat for waterfowl and upland birds as resting areas.

Up to 8,500 acres of rice stubble have been flooded in the past, with associated winter habitat benefits to migratory waterfowl that use the area as part of the Pacific Flyway. Additionally, the District serves approximately 1,000 acres of privately owned duck clubs. No managed designated environmental or wetlands areas are within the District.

Groundwater Recharge.

Topography and Soils.

Transfers and Exchanges.

Other Uses.

District Facilities.

Diversion Facilities. PID's primary water supply facility is a surface water diversion on the Sacramento River at Sidds Landing Pump Station. The District operates Sidds Landing Pump Station in cooperation with PCGID. The District also operates two gravity surface diversions on adjacent drainage channels that convey return flows from GCID lands to the west of PID. Table 2-19 summarizes PID's surface water supply facilities. See Figure 2-19 for a map of PID's major conveyance facilities.

TABLE 2-19 PID Surface Water Supply Facilities

2009 Sacramento Valley Regional Water Management Plan Annual Update

			Capacity	Average Historical Diversion
Facility Name	Water Source	Pump/Gravity	(cfs)	(ac-ft/yr)
Sidds Landing Pump Station	Sacramento River	Pump	605	58,000
Drain 13 Gravity Surface Diversion	Drain 13	Gravity	100	9,500
Drain 55 Gravity Surface Diversion	Drain 55	Gravity	100	30,000

During the 1976 to 1977 drought, PID installed three groundwater wells to supplement its water supply. An additional well was installed in 1991. Table 2-20 summarizes the District's groundwater well data. During the drought of 1986 to 1993, several private groundwater wells were installed. There is no formal agreement between the District and the landowners regarding pumping of private wells. Approximately 7,200 ac-ft/yr can currently be pumped from the groundwater wells within the District.

Conveyance System.

Storage Facilities.

Spill Recovery.

## 2.2.4.4 District Operating Rules and Regulations

# 2.2.4.5 Water Measurement, Pricing, and Billing

PID currently measures flows at the main pump stations with flowmeters. District wells and drain pumps are metered. Lateral headgate flows are measured using stage and gate

position, or stage and weir geometry at flashboard turnouts. Minor increases in conveyance efficiency could be achieved by improved operations measurement, with installation of measuring facilities at intermediate points along the main canal, and improved measuring at the heads of laterals. These new measurement facilitates would be integrated with the operations automation program described above to increase overall distribution system efficiency.

PID does not currently meter field turnouts. Flow rates at turnouts are estimated based on head-flow relationships for the turnout orifices or weirs. The District does not record total delivery to each customer. The average on-farm efficiency for the District is approximately 64 percent, which is near the assumed practical upper limit of around 70 percent. Field-level metering in combination with incentive pricing and on-farm improvements may potentially increase the average on-farm efficiency and provide a relatively minor quantity of conserved water. Table 2-23A presents an inventory of the District's water measurement devices.

TABLE 2-23A
Agricultural Measurement Device Inventory for PID

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Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Propeller	19	+/-5%	Daily	Yearly	Yearly
Weirs	1	+/-10%	Daily	NA	Yearly
Total	20				

# 2.2.5 Princeton-Codora-Glenn Irrigation District

## 2.2.5.1 History

PCGID (or the District) was organized on December 9, 1916, under the California Irrigation District Act of 1897. The District was organized to take over from the receiver of the Sacramento Valley West Side Canal Company a portion of the River Branch canal system.

In 1964, the District entered into a negotiated agreement with Reclamation quantifying the amount of water PCGID could divert from the Sacramento River. The resulting negotiated agreement recognized PCGID's annual entitlement to a Base Supply of 52,810 ac-ft/yr of flows from the Sacramento River and also provided for a 15,000 ac-ft allocation of Project Supply, resulting in a total contract entitlement of 67,810 ac-ft/yr. The schedule of monthly diversions of the Contract Total, Base Supply, and Project Supply are identified in Exhibit A to the Settlement Contract for PCGID and are included in Table 2-24. The Settlement Contract negotiated in 1964 remains in effect until March 2006. PCGID has worked with Reclamation and counsel to finalize environmental documentation for contract renewal for a new 40-year contract with 52,810 ac-ft of Base Supply and 15,000 ac-ft of Project Supply.

## 2.2.5.2 Service Area and Distribution System

## 2.2.5.3 Water Supply

Surface Water. The PCGID surface water supply entitlement is currently addressed in a contract entered into with Reclamation in 1964, Contract No. 14-16-200- 0849A (Contract No. 0849A). This contract provides for an agreement between PCGID and the United States on PCGID's diversion of water from the Sacramento River during the period April 1 through October 31 of each year. This contract expired March 31, 2004. However, Congress granted a 2-year extension; therefore, the contract will remain in effect until March 31, 2006. PCGID worked with Reclamation and counsel to finalize environmental documentation for the new contract renewal, which has taken effect for another 40 years at the same quantities of water that were agreed upon in the 1964 contract.

Contract No. 0849A provides for a maximum total of 67,810 ac-ft/yr, of which 52,810 ac-ft is considered to be Base Supply and 15,000 ac-ft is CVP water (Project Supply), as shown in Table 2-26. The contract also provides that additional Project Supply can be purchased if surplus water is available.

The contract specifies the total quantity of water that may be diverted by PCGID each month during the period April through October each year. The monthly distribution of the Base and Project Supply is shown on Figure 2-20. The monthly Base Supply ranges from a minimum of 1,400 ac-ft in August to a maximum of 13,500 ac-ft in May. CVP water (Project Supply) is available during the months of June, July, August, and September with entitlements of 400, 6,000, 8,400, and 200 ac-ft, respectively. The contract identifies July, August, and September as the critical months. For the critical months, the total Base Supply is 14,320 ac-ft, and the total Project Supply is 14,600 ac-ft.

#### Settlement Contract Historical Diversions.

Non-contract Period (November – March). Contract No. 0849A does not limit PCGID from diverting water for beneficial use during the months of November through March, to the extent authorized under California law. PCGID has filed for and received a water right permit for non-contract-period diversions in the amount of approximately 24,400 ac-ft. Non-contract-period diversions are predominantly used for rice straw decomposition and pre-irrigation. PCGID has historically irrigated in months prior to April (pre-irrigation), especially for orchards, tomatoes, and sugar beets. In response to increasingly stringent limitations on burning, some of the District's landowners flood a portion of their fields to clear their land of leftover rice straw by allowing the rice stubble to decompose. Approximately 1,200 to 2,500 acres have been flooded in the past. A lower percentage of rice acreage is flooded in PCGID compared to other adjacent districts because of the high cost of decomposition water (relative to other districts).

Other Surface Water Sources.

Groundwater.

Other Water Supplies.

Water Use.

#### 2.2.5.4 District Facilities

Diversion Facilities. PCGID operates one pumping plant on the Sacramento River. The Sidds Pumping Plant is located north of the community of Glenn at Sidds Landing and includes eight pump/motor units of various horsepower ratings and a combined capacity of approximately 605 cfs. The new Sidds Plant was built in the late 1990s with PID with a capacity of 605 cfs. The facility has shared operation between the two districts. Table 2-28 summarizes PCGID's surface water supply facilities. See Figure 2-23 for a map of PCGID's major conveyance facilities.

**TABLE 2-28** 

PCGID Surface Water Supply Facilities

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Facility Name	Water Source	Pump/Gravity	Capacity (cfs)	Average Historical Diversion (ac-ft/yr)
Sidds Landing Pump Station	Sacramento River	Pump	605	65,000
Schaad Pump Station	Sacramento River	Pump	0	0

PCGID operates five District-owned wells. Operation of these wells is coordinated with the Sacramento River pump stations to maximize flexibility and provide additional supplies during drought periods. Table 2-29 summarizes the District-owned groundwater wells. In addition, approximately 15 private wells are located within the District boundary. The District has no formal agreement with growers with regard to pumping private wells. Approximately 6,000 ac-ft/yr are available for pumping from the wells that are currently developed.

**Conveyance System**. The District's distribution and conveyance system includes approximately 63 miles of canals and laterals, including the 15 miles of main canal from the Sacramento River diversion point.

PCGID's distribution system includes approximately 63 miles of unlined canals and main laterals. The River Branch Canal conveys water from Sidds Landing Pump Station at the northern end of the District down to the Armfield, Barnes, and four laterals in the central and southern portions of the District. The Schaad Pump Station has been replaced by the increased Sidds Landing Station capacity that now also supplies the Tobin Canal, Hart Canal, and the southern end of the River Branch Canal. Based on testing conducted in 1997, main canal seepage has been found to be approximately 20 percent. Due to the proximity of the river and associated soils, seepage among the other District canals is assumed to vary from 15 to 25 percent. Table 2-30 summarizes PCGID's main canal and irrigation lateral features.

Storage Facilities.

Spill Recovery.

2.2.5.5 District Operating Rules and Regulations

## 2.2.5.6 Water Measurement, Pricing, and Billing

PCGID currently measures flows at the main pump stations with flowmeters. District wells and all drain pumps are metered. Lateral headgate flows are measured using stage and gate position, or stage and weir geometry at flashboard turnouts. Minor increases in conveyance efficiency could be achieved by improved operations measurement, with installation of measuring facilities at intermediate points along the main canal and improved measuring at the heads of laterals. These new operations measurement facilitates would be integrated with the operations automation program described above to increase overall distribution system efficiency.

PCGID does not currently meter field turnouts. Flow rates at turnouts are estimated based on head-flow relationships for the turnout orifices. The District does not record total delivery to each customer. The District has installed flowmeters on field turnouts in the past and experienced clogging by the debris that is common in earthen canals. The frequent clogging required cleaning of meters and resulted in poor accuracy. The average on-farm efficiency for the District is approximately 64 percent, which is near the assumed practical upper limit of around 70 percent (Reclamation). Field-level metering in combination with incentive pricing and on-farm improvements may potentially increase the average on-farm efficiency and provide a significant quantity of conserved water. The associated capital and O&M costs for metering would likely result in significant rate increases to District customers. Table 2-31A presents an inventory of the District's water measurement devices.

TABLE 2-31A
Agricultural Measurement Device Inventory for PCGID
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Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Propeller	14	+/-5%	Daily	Yearly	Yearly
Weirs	1	+/-10%	Daily	NA	Yearly
Total	15				

#### 2.2.6 Reclamation District No. 108

## 2.2.6.1 History

## 2.2.6.2 Service Area and Distribution System

## 2.2.6.3 Water Supply

Surface Water. RD 108 holds a water right, primarily under 1917 and 1918 priority dates, to divert water from the natural flow of the Sacramento River. The RD 108 surface water supply entitlement was initially addressed in a contract entered into with Reclamation in 1964, Contract No. 14-06-200-0876A (Contract No. 0876A). This contract provided for an agreement between RD 108 and the United States on RD 108's diversion of water from the Sacramento River during the period April 1 through October 31 of each year. The length of this contract was 40 years and remained in effect until March 31, 2006, when it was extended an additional 40 years (Contract No. 876A-R-1). The various RD 108 water right maximum quantities and sources are summarized in Table 2-33.

Contract No. 0876A provided for a maximum total of 253,500 ac-ft/yr, of which 199,000 ac-ft was considered to be Base Supply and 54,500 ac-ft was CVP water (Project Supply). In 1974, the District reduced its Project Supply allocation to 33,000 ac-ft with the expectation that conservation efforts including canal lining and recirculation of drainage water by the District would reduce diversion requirements. Thus, the current contract provides for a maximum total of 232,000 ac-ft/yr, of which 199,000 ac-ft is considered to be Base Supply, and 33,000 ac-ft is CVP water (Project Supply), as shown in Table 2-34. The contract also provides that additional Project Supply can be purchased if surplus water is available.

The contract specifies the total quantity of water that may be diverted by RD 108 each month during the period April through October each year. The monthly distribution of the Base and Project Supply is shown on Figure 2-24. The monthly Base Supply ranges from a minimum of 1,500 ac-ft in October to a maximum of 50,500 ac-ft in May. CVP water (Project Supply) is available during the months of July, August, and September with entitlements of 16,000, 15,000, and 2,000 ac-ft, respectively. The contract identifies July, August, and September as the critical months. For the critical months, the total Base Supply is 64,000 ac-ft, and the total Project Supply is 33,000 ac-ft.

#### Settlement Contract Historical Diversions.

Non-contract Period (November – March). Contract No. 0876A does not limit RD 108 from diverting water for beneficial use during the months of November through March, to the extent authorized under California law. RD 108 also has riparian water rights to the Sacramento River, which allow for diversion during the entire water year (October through September). RD 108 has historically irrigated in months prior to April (pre-irrigation), especially for tomatoes and grain crops. With the phase-out of rice straw burning over the past several years, there has been an increased interest by rice growers in fall and winter flooding of rice fields to enhance decomposition of rice straw and stubble. An average of 12,000 acres was flooded each of the past 6 years.

Other Surface Water Sources.

Groundwater.

Other Water Supplies.

Water Use

District Water Requirements. Rice is the predominant crop grown within RD 108's service area. Other key crops include tomatoes, safflower, wheat, alfalfa, corn, and vineseed. Rice accounts for approximately 72 percent of the District's irrigated acreage on an annual basis. As is the case with most of the other districts, water requirements are typically highest during the summer months (July and August) due to the requirements of rice and the area's hot, dry climate. Cultural practice water needs for rice are greatest early in the growing season associated with the flooding up of previously dry rice fields, as well as to meet the needs of other crops. Irrigation water requirements are met through the contract surface water supply.

Annual cropping patterns have remained fairly constant over the last few decades, other than in response to farm programs in the early 1980s. Associated water requirement needs

and associated diversions have therefore been more a function of water-year type and climate than changes in cropping.

Table 2-35 shows current (1995 normalized estimates) irrigated acreage estimates for the primary crops grown within the District service area, as well as projections for 2020. The variation around these estimates (± percentage figures) was provided by the District to account for typical variations in particular crop acreage (primarily due to year type), as well as anticipated future variation.

Figure 2-26 summarizes irrigated acreage by crop, on-field water requirements, and TDRs.

With the phase-out of rice straw burning over the past several years, there has been an increased interest by rice growers in fall and winter flooding of rice fields to enhance decomposition of rice straw and stubble. An average of 12,000 acres was flooded during each of the past 6 years. This practice provides additional winter habitat for waterfowl above that which has been available within the Sacramento Valley since the development of agriculture. The District is actively working with Yolo County Resource Conservation District and Reclamation on a demonstration program of planting native vegetation along the District's irrigation and drainage canals to prevent erosion of levee slopes, to improve water quality, and to enhance wildlife habitat.

Future irrigation season cropping patterns and associated water requirements are anticipated to remain relatively the same as current conditions.

#### Urban.

**Environmental**. Approximately 100 acres of riparian vegetation are estimated to be incidentally supplied by irrigation, including vegetation directly adjacent to delivery laterals or influenced by leakage from the delivery system. Such vegetation includes habitat used by the federally listed giant garter snake. The flooding of rice fields in the spring and summer provides wetlands habitat during these periods for waterfowl and terrestrial species. Rice fields that are not flooded also provide habitat for waterfowl and upland birds as resting areas.

As described above, up to 12,000 acres of rice stubble have been flooded in the past, with associated winter habitat benefits to migratory waterfowl that use the area as part of the Pacific Flyway. No managed designated environmental or wetlands areas are within the District.

Groundwater Recharge.

Topography and Soils.

Transfers and Exchanges. RD 108 is one of 34 SRSCs that currently participate in the Pool program. Since 1974 the Pool has been the forum to move available Project Supply supplies within certain years to other SRSCs. Each year, members participating in the Pool have the option to identify a quantity of their respective Project Supply that they wish to make available to the Pool rather than for diversion.

Other Uses.

**District Facilities** 

Diversion Facilities. RD 108's primary water supply facilities include five pumping plants along the Sacramento River for diversion of water. The largest of these is the Wilkins Slough Pumping Plant and Fish Screen Structure near the northeast boundary of the District, which supplies the Wilkins Slough Main Canal. The District completed the new 300-cfs Emery Poundstone Pumping Plant and Fish Screen facility in 2007, which replaced the Boyer's Bend, Howell's Landing, and Tyndall Mound pump stations. Table 2-36 summarizes RD 108's surface water supply facilities. See Figure 2-27 for a map of RD 108's major conveyance facilities.

Conveyance System. RD 108's distribution and conveyance system includes approximately 84 miles of earthen canals and 35 miles of concrete-lined canals. The Wilkins Slough Main Canal serves laterals in the northern and western portions of the District, and is supplied from the Wilkins Slough Pumping Plant. Irrigation Canals 12, 13, and 15 serve the central portion with water from the Emery Poundstone Pumping Plant. Irrigation Canal 14 serves the western and southern boundary of the District and is supplied from the El Dorado Bend Pump Station. Several of these canals can also be supplied by the District's drain recapture pumps, as described below. Table 2-37 summarizes RD 108's primary distribution facilities.

TABLE 2-36
RD 108 Surface Water Pumping Facilities
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Facility Name	Water Source	Pump/Gravity	Capacity (cfs)	Average Historical Diversion (ac-ft/yr)
Wilkins Slough Pumping Plant	Sacramento River	Pump/Gravity	830	95,000
Emery Poundstone Pumping Plant	Sacramento River	Pump/Gravity	300	38,900 <sup>a</sup>
Steiner Bend – N Pump Station	Sacramento River	Pump	15	350
Steiner Bend – S Pump Station	Sacramento River	Pump	30	1,600
El Dorado Bend Pump Station	Sacramento River	Pump/Gravity	80	6,400

<sup>&</sup>lt;sup>a</sup>Sum of historical diversions of the three pumping plants replaced.

TABLE 2-37
RD 108 Canals and Laterals
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Facility Name	Source Facility	Capaci ty (cfs)	Lined	End Spill Location	Percent Leakage Loss Estimate
Wilkins Slough Main Canal	Wilkins Slough Pumping Plant	830	Earth	None	а
Irrigation Canals No. 12, 13, and 15	Emery Poundstone Pumping Plant	300	Concrete	Main Drainage Canal	
Irrigation Canal No. 14	El Dorado Pumping Plant	300	Earth	Main Drainage Canal	а
Irrigation Canal No. 10P	Riggs Ranch Drain Pump	200	Earth	Main Drainage Canal	а

<sup>a</sup>Varies. See District deep percolation studies.

In 1997, RD 108 began upgrading and automating major supply and canal control facilities. Currently, 90 percent of the District's facilities are linked via a centralized SCADA system. The District is continuing this program with the goal of automating major canal and lateral control structures. Operational spills are currently at the lower practical amount for an open-channel irrigation system, and further significant reductions are limited. Conveyance system automation, when essentially completed over the next few years, will be fully developed as a management option for RD 108 and does not offer significant potential for new water conservation.

Storage Facilities. As noted previously, RD 108 has the ability to retain its drainage for reuse. This resulted in average annual savings of 53,000 ac-ft. Recently, this has been found to reduce water quality and therefore some drainage is now pumped out of the District to control salinity levels within the soil.

Spill Recovery. RD 108 has an extensive network of drainage facilities, including over 300 miles of drains and five major drain pump stations for removal or reuse of irrigation return flows and winter stormwater runoff. Because of the topography and the surrounding levees, drainage must be pumped out of the District. The drainage is generally conveyed to the southeast corner of the District where the Rough and Ready, El Dorado Bend, and Sycamore Slough pumping plants are used to convey the drainage either through the flood control levees and into the Sacramento River or back into the distribution laterals for reuse. Sycamore Slough lifts drainage water into Lateral 14A, which conveys water to El Dorado for removal or to the irrigation system for reuse. The Riggs Ranch Pumping Plant conveys drainage from the northern portion of the District into either the Colusa Basin Drain or back into the supply conveyance system (Irrigation Canal 10P) for reuse. The Lateral 8 Pumping Plant lifts drainage water into Wilkins Slough Main Canal for reuse. The Rough and Ready Drain Pump Station shown on Figure 2-27 is not used for irrigation. The pump discharges regional drainage into the Sacramento River when a gravity discharge is prevented by a high river stage. Tables 2-38 and 2-39 summarize the main RD 108 drainage facilities.

TABLE 2-38
RD 108 Reuse Pump Stations
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Pump Station ID	Source	Discharges To	Capacity (cfs)	Average Historical Pumping Total (ac-ft/yr)
Sycamore Slough	Main Drainage Canal	Irrigation Canal 14	220	25,000
Riggs Ranch	Drain No. 9	Irrigation Canal 10P/Colusa Basin Drainage Canal	70	7,000
Lateral 8	Drain No. 8	Wilkins Slough Main Canal	180	20,000

## 2.2.6.4 District Operating Rules and Regulations

## 2.2.6.5 Water Measurement, Pricing, and Billing

Reclamation currently measures water at each of the five Sacramento River pump stations using flowmeters. RD 108 measures drain pump and reuse pump flows using pump curves. Drain flows leaving the District service area are also metered at the pump stations that are used to discharge the drainage into the Sacramento River. Flows in canals and laterals are

measured using head measurements at gates and weirs. Some improvement in water measurement could be achieved along main canals and laterals with the installation of low-headloss flow measurement devices.

RD 108 measures flow rate at turnouts using head-discharge relationships for orifices and gates. Flow rates are set to match the field demand based on the irrigation method and field conditions. The total quantity of water delivered to each turnout is not currently recorded. The average on-farm efficiency for the District is approximately 66 percent, which is near the practical upper limit of around 70 percent. Operating conditions such as minimal head differential between supply laterals and fields and canal debris make widespread use of flowmeters impractical for nearly all turnouts. The most practical method for quantifying delivery at turnouts may involve improved water level recording and control in the laterals, combined with recording of delivery times and flow rates at each turnout. This method will be attempted for 12,000 acres dominated by row crops during 2009. Some method of quantification, along with field-level improvements and appropriate price incentives, may provide improved field-level efficiency. Table 2-39A presents an inventory of the District's water measurement devices.

TABLE 2-39A
Agricultural Water Measurement Inventory for RD 108
2009 Sacramento Valley Regional Water Management Plan Annual Update

Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Propeller	6	+/-5%	Continuously	Maintained yearly	by Reclamation
Weirs	37	+/-10%	Daily	NA	Yearly
Metered Gates	691	+/-10%	Daily	Calibrated at installation	Yearly
Ultrasonic – Pipe	6	+/-5%	Continuously	Calibrated at installation	Yearly
Ultrasonic – Channel	1	+/-5%	Continuously	Calibrated at installation	Yearly
Verified Pump Curve	8	+/-10%	Daily	Every 5 years	NA
Rubicon Overshot Leaf Gate	17	+/-5%	Continuously	Calibrated at installation	Yearly
Total	779				

# 2.3 Butte Sub-basin

- 2.3.1 Water Supply within the Butte Sub-basin
- 2.3.2 Water Use within the Butte Sub-basin
- 2.3.3 Reclamation District No. 1004

#### 2.3.3.1 History

## 2.3.3.2 Service Area and Distribution System

RD 1004 is located on the east side of the Sacramento River approximately 2 miles east of the town of Colusa and directly west of the Sutter Buttes. The District is primarily in Colusa County, with the southeasternmost portion extending into Sutter County and the extreme northern portion in Glenn County. Butte Creek runs along a portion of the eastern edge of RD 1004. The District's service area encompasses approximately 26,000 acres and includes 48 landowners. Rice is the predominant crop grown within the District.

## 2.3.3.3 Water Supply

Surface Water. The RD 1004 surface water supply entitlement is currently addressed in a contract entered into with Reclamation in 1964, Contract No. 14-06-200-0890A (Contract No. 0890A). This contract provides for an agreement between RD 1004 and the United States on RD 1004's diversion of water from the Sacramento River during the period April 1 through October 31 of each year. This contract was set to expire March 31, 2004. However, Congress granted a 2-year extension; therefore, the contract will remain in effect until March 31, 2006. RD 1004 is working with Reclamation and counsel to finalize environmental documentation for the proposed contract renewal, expected to take effect for another 40 years at the end of the 2-year extension.

Contract No. 0890A provides for a maximum total of 71,400 ac-ft/yr, of which 56,400 ac-ft is considered to be Base Supply and 15,000 ac-ft is CVP water (Project Supply), as shown in Table 2-43. The contract also provides that additional Project Supply can be purchased if surplus water is available.

The contract specifies the total quantity of water that may be diverted by RD 1004 each month during the period April through October each year. The monthly distribution of the Base and Project Supply is shown on Figure 2-31. The monthly Base Supply ranges from a minimum of 3,600 ac-ft in August to a maximum of 14,700 ac-ft in May. CVP water (Project Supply) is available during the months of July, August, and September with entitlements of 6,000, 8,400, and 600 ac-ft, respectively. The contract identifies July, August, and September as the critical months. For the critical months, the total Base Supply is 17,900 ac-ft, and the total Project Supply is 15,000 ac-ft, as shown in Table 2-43.

Settlement Contract Historical Diversions.

Non-contract Period (November - March).

Other Surface Water Sources. Butte Creek is located along the eastern edge of the RD 1004 service area, and Butte Slough is located on the southeastern edge. RD 1004 has established water rights to both Butte Creek and Butte Slough, and has permits to divert water from these sources, as shown in Table 2-42.

Groundwater.

Other Water Supplies.

Water Use

#### 2.3.3.4 District Facilities

## 2.3.3.5 District Operating Rules and Regulations

## 2.3.3.6 Water Measurement, Pricing, and Billing

Water measurement is considered fully implemented as a conservation measure at RD 1004. The District measures flow and quantity at its river diversion pump stations using flow-meters. Canal and lateral flow rates are measured using meters and totalizers installed at intermediate points such as road culverts. The one District well is metered. Drain pump flows are estimated based on power consumption and pump efficiency data. The only operations level that is not metered is the drain pumps, although the power consumption records and efficiency data provide fairly accurate estimates of total volumes pumped.

RD 1004 has flowmeters installed on its customer turnouts. The meters are read and cleaned regularly, generally every 2 days. The District uses the meter data to record flow rates and total volume delivered at each turnout. These data are then used for the billing, which is based on a dollar-per-ac-ft charge. Table 2-47A presents an inventory of the District's water measurement devices.

TABLE 2-47A
Agricultural Measurement Device Inventory for RD 1004
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Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Propeller	135	+/-5%	1 to 3 days	As needed	Yearly or as needed
Total	135				

# 2.4 Sutter Sub-basin

- 2.4.1 Water Supply within the Sutter Sub-basin
- 2.4.2 Water Use within the Sutter Sub-basin
- 2.4.3 Meridian Farms Water Company
- 2.4.3.1 History
- 2.4.3.2 Service Area and Distribution System

MFWC is located on the east side of the Sacramento River east of the community of Meridian and directly southwest of the Sutter Buttes. The Company encompasses approximately 9,900 acres and serves 73 landowners. The main pumping facility is located at River Mile 134 on the Sacramento River.

MFWC uses an arranged schedule to deliver irrigation water to Company customers. MFWC also pumps water from the Sacramento River using two other pump stations. The Company's distribution and conveyance system includes approximately 16 miles of main canals and 19 miles of major laterals. Seepage from the canals and laterals is approximately

15 percent. MFWC coordinates drain operations with RD 70, and has no specific agreements in place to handle floodwaters. MFWC has usable groundwater resources within its boundaries and uses groundwater as a normal part of its resource mix, although some nearby wells have low-quality groundwater as a result of connate water upwelling. The western edge of the Company abuts a number of independent farmers with individual contracts with Reclamation. These landowners, called "rimlanders," are not within Company boundaries, but contribute runoff that may be reused by Company farmers. Past efforts to coordinate operations with these landowners have failed.

The Company relies heavily on runoff to supplement their own water sources. The Company is able to reuse a large portion of its due to the flat physiography of the area and the use of Long Lake and several pumps that can "step" water to the upper reaches of the Company. MFWC currently uses an average of 15,000 ac-ft/yr of runoff, equivalent to approximately 60 percent of the Company's average Sacramento River diversion.

MFWC continues to aggressively maintain their system and work with farmers to maintain irrigation reliability and efficiency. In Fiscal Year 2008, MFWC worked with a farmer to help secure Pacific Gas and Electric Company grants to implement a spray emitter system for his 120 acres of walnuts that were previously flood irrigated. MFWC also concrete lined 1,180 feet of earthen canal and began construction on a new 30-cfs diversion as part of their requirements under the 1992 CVPIA mandate. This construction will be completed in August 2009, and implemented to full operation by Fiscal Year 2010.

## 2.4.3.3 Water Supply

Surface Water. The MFWC surface water supply entitlement is currently addressed in a contract entered into with Reclamation in 1964, with a renewal date of April 1, 2005; and is set to expire March 31, 2045, Contract No. 14-06-200-0838A (Contract No. 0838A). This contract provides for an agreement between MFWC and the United States on MFWC's diversion of water from the Sacramento River during the period April 1 through October 31 of each year.

Contract No. 0838A provides for a maximum total of 35,000 ac-ft/yr, of which 23,000 ac-ft is considered to be Base Supply and 12,000 ac-ft is CVP water (Project Supply), as shown in Table 2-51. The contract also provides that additional Project Supply can be purchased if surplus water is available.

The contract specifies the total quantity of water that may be diverted by MFWC each month during the period April through October each year. The monthly distribution of the Base and Project Supply is shown on Figure 2-38. The monthly Base Supply ranges from a minimum of 1,100 ac-ft in August to a maximum of 6,200 ac-ft in May. Although the contract period is April through October, no Base or Project Supply is allocated for the month of October. However, Base and Project Supply, can be shifted between non-critical months. CVP water (Project Supply) is available during the months of July, August, and September with entitlements of 5,000, 5,000, and 2,000 ac-ft, respectively. The contract identifies July, August, and September as the critical months. For the critical months, the total Base Supply is 6,500 ac-ft, and the total Project Supply is 12,000 ac-ft, as shown in Table 2-51.

Settlement Contract Historical Diversions.

Non-contract Period (November - March).

Other Surface Water Sources.

Groundwater.

Other Water Supplies.

Water Use

- 2.4.3.4 District Facilities
- 2.4.3.5 District Operating Rules and Regulations

## 2.4.3.6 Water Measurement, Pricing, and Billing

MFWC measures water at its three river diversion pump stations using flowmeters. Canal and lateral flow rates are measured using weir or gate head/flow curves. Wells are metered. Drain pump flows are estimated based on power consumption and pump efficiency data. Minor increases in water savings are possible through a program of improved water measurement that includes installation of intermediate measurement points along the main canals, improved lateral headgate measurement, and drain pump metering. These new measurement facilitates would be integrated with the operations automation program described above to increase overall distribution system efficiency.

MFWC does not meter individual customer turnouts. Flow rates at field turnouts are measured using head/orifice relationships. MFWC does not measure and record the total quantity of water delivered to each turnout. MFWC's on-farm efficiency is approximately 65 percent. Field metering, in combination with a modified delivery arrangement, an appropriate incentive pricing structure, and on-field improvements such as land leveling may increase the average on-farm efficiency, with minor savings in water use. The effective implementation of such a program would depend on optimal combination of the above components, in addition to basic economic considerations such as the return on investment to the Company and landowner. The installation, maintenance, and reading of the 150 meters would represent a major upfront capital cost to the Company as well as an ongoing labor and capital expense. Table 2-56A presents an inventory of the Company's water measurement devices.

TABLE 2-56A
Agricultural Measurement Device Inventory for MFWC
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Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Propeller	4	10%	Weekly	Yearly	Yearly
Weirs	107	5%	Daily	NA	Yearly
Total	111				

# 2.4.4 Sutter Mutual Water Company

## 2.4.4.1 History

SMWC (or the Company) was formed February 5, 1919, under the California corporation laws and codes. The Company entered into a negotiated contract with Reclamation in 1964, quantifying the amount of water SMWC could divert from the Sacramento River. The contract was re-negotiated in 2005, resulting in SMWC's annual entitlement of a 169,500 ac-ft/yr Base Supply for water diversion from the Sacramento River. The contract also provided a 56,500 ac-ft allocation of Project Supply, resulting in a total contract entitlement of 226,000 ac-ft/yr. The schedule of monthly diversions of the Contract Total, Base Supply, and Project Supply are identified in Exhibit A to the Settlement Contract for SMWC and is included in Table 2-57. The Settlement Contract negotiated in 1964 remained in effect until March 2006. SMWC completed negotiations with Reclamation for a contract renewal and executed that contract in 2005. In addition to the contract water, SMWC has entitlements to pump water during the non-irrigation season for wetlands and rice straw decomposition owing to appropriative rights during the winter months of approximately 250 cfs.

## 2.4.4.2 Service Area and Distribution System

SMWC is located approximately 45 miles northwest of Sacramento and is bordered by three levee systems. The Company encompasses approximately 50,000 acres and serves 150 landowners. Company boundaries encompass the Town of Robbins. The Company operates four pumping plants at three locations: Tisdale Pumping Plant (960-cfs capacity), State Ranch Bend Pumping Plant (128-cfs), and Portuguese Bend Pumping Plant (106-cfs). SMWC also has nine booster pump sites (they typically operate four to five in any given year). These facilities are used for water reuse and are located in the central and northeast portions of the Company.

SMWC is interlaced with drainage ditches (which are operated and maintained by RD 1500) that carry water toward the Main Drain and eventually out of the service area at the southern end of the Company at the Karnak Pump Station. Drainage ditches in the eastern portion of the Company also intercept naturally occurring saline groundwater, called "connate water." This saline groundwater tends to be most prevalent toward the eastern portion of the Company associated with artesian pressure through the Sutter Basin Fault. Salinity concentrations tend to increase with depth (NRCS, 1996). Irrigation practices using Sacramento River water and drainage systems have allowed the Company and other districts/landowners to maintain suitable crop yields and keep the connate water below the crop root zones.

The western edge of the Company abuts a number of independent farmers with individual contracts with Reclamation. These landowners, called "rimlanders," are not within Company boundaries, but contribute drain water to the RD 1500 drainage system. Company operations are coordinated with RD 1500 and Pelger Mutual Water Company. RD 1500 manages drainage in the service area, and SMWC delivers water to the majority of water users in the area.

SMWC uses an arranged schedule to deliver irrigation water to Company customers. The Company's distribution and conveyance system includes approximately 56 miles of

irrigation water delivery canals and 144 miles of laterals. Delivery system leakage associated with the operation of the Company is approximately 15 to 18 percent of the diversion during the spring, summer, and early fall irrigation season. Approximately 38 privately owned wells have been drilled within the Company boundaries, but most have been curtailed or abandoned due to high salinity levels and lack of sustained yield as discussed above. Reuse of water is driven in part by year type; however, the high water table and its saline nature limit the amount of water that can be successfully reused without impacting crop yields and salt accumulation in the soil profile. Winter operations call for most drains to be opened around Labor Day of each year to allow for the dewatering of the Basin in preparation for the passage of winter surface and sub-surface flows.

## 2.4.4.3 Water Supply

Surface Water. SMWC, formed in 1919, holds a water right to divert water from the natural flow of the Sacramento River. The SMWC surface water supply entitlement is currently addressed in a contract entered into with Reclamation in 1964, Contract No. 14-06-200-0815A (Contract No. 0815A) and re-negotiated in 2005. This contract provides for an agreement between SMWC and the United States on SMWC's diversion of available water from the Sacramento River during the period April 1 through October 31 of each year.

The renewed Contract No. 0815A provides for a maximum total of 226,000 ac-ft/yr, of which 169,500 ac-ft is considered to be Base Supply and 56,500 ac-ft is CVP water (Project Supply), as shown in Table 2-59. The contract also provides that additional Project Supply can be purchased if surplus water is available.

The renewed contract specifies the total quantity of water that may be diverted by SMWC each month during the period April through October each year. The monthly distribution of the Base and Project Supply is shown on Figure 2-42. The monthly Base Supply ranges from a minimum of 5,000 ac-ft in September to a maximum of 48,000 ac-ft in May. CVP water (Project Supply) is available during the months of July, August, and September with entitlements of 25,000, 24,000, and 7,500 ac-ft, respectively. The contract identifies July, August, and September as the critical months. For the critical months, the total Base Supply is 53,500 ac-ft, and the total Project Supply is 56,500 ac-ft, as shown in Table 2-59.

#### Settlement Contract Historical Diversions.

Non-contract Period (November – March). In addition to the contract water, SMWC has entitlements to pump water during the non-contract period for other uses including rice straw decomposition given appropriative rights during the non-contract months. These entitlements allow for a maximum diversion of 250 cfs. Approximately 4,000 to 10,000 acres have been flooded in the past for rice straw decomposition. Due to flood control and drainage concerns, the maximum acreage that may be flooded is considered and managed by acreage limitations adopted by the Company each year.

Other Surface Water Sources.

#### Groundwater.

Other Water Supplies. SMWC presently uses approximately 15,000 to 45,000 ac-ft/yr of drainage water from sources both inside and outside of the Company. Private landowners pump an additional 5,000 to 15,000 ac-ft from these sources. The western edge of the

Company abuts a number of independent farmers with individual contracts with Reclamation. Company operations are coordinated with RD 1500 and PMWC. RD 1500 manages drainage in the service area, while SMWC delivers water to the majority of water users in the basin area.

SMWC currently operates nine booster pumps and has dismantled one internal recirculation system (ML 10, which had three booster pump locations but is now inoperative) with a total combined capacity of 190 cfs. These facilities are used for reuse and are located in the central and northeast portions of the Company. SMWC is interlaced with drainage ditches that carry water towards the main drain and eventually out of the service area at the southern end of the Company. Drainage ditches in the eastern portion of the Company intercept naturally occurring saline groundwater, called "connate water." This salt-laden groundwater seeps into the drain ditches and causes an increase in salinity in the drains. Irrigation practices using Sacramento River water and drainage systems have allowed the Company and other districts/landowners to maintain suitable crop yields and keep the connate water below the crop root zones. Continued reuse and recycling efforts are expected to be influenced by an increasing need to manage salinity and other constituents that affect crop productivity and sustainability.

#### 2.4.4.4 Water Use

Company Water Requirements. The two major crops grown within the Company's service area are tomatoes (grown in rotation with wheat, safflower, and beans) and rice (sometimes grown in rotation with wheat, safflower, beans, and melons, or grown 7 or 8 years consecutively without rotation).

Rice is the predominant crop grown within SMWC's service area, accounting for in recent years approximately 40 to 60 percent of the Company's irrigated acreage on an annual basis. As is the case with most of the other districts, water requirements are typically highest during the summer months (June, July, and August) due to the requirements of rice and the area's hot, dry climate. Cultural practice water needs for rice and other crops are greatest early in the growing season during dry years associated with irrigating previously dry fields. The vast majority of irrigation water requirements are met through the contract surface water supply, although recaptured drainwater is used depending on availability and quality.

Annual cropping patterns have changed a great deal over the last few decades, as rice acreage had declined substantially but in recent years rice acreage has increased noticeably with other crops leaving the area or becoming unprofitable. The prevalence of relatively rich, well-drained soils allows for a diversity of crops within the Company boundary. Tomato acreage has declined in recent years due to processors (canneries) leaving the area resulting in more acres of rice and substitute crops. Therefore, associated water requirement needs and associated diversions are driven by changes in cropping patterns, as well as water-year type.

Table 2-60 shows current (1995 normalized estimates) irrigated acreage estimates for the primary crops grown within the Company service area, as well as projections for 2020. The variation around these estimates (± percentage figures) was provided by the Company to

account for typical variations in particular crop acreage (primarily due to year type), as well as anticipated future variation.

TABLE 2-60
SMWC Irrigated Acreage – 1995 and 2020 Estimates
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Сгор	1995 <sup>a</sup>	2020 <sup>b</sup>
Rice	17,400 (± 10%)°	26,000 (± 25%) <sup>c</sup>
Tomatoes	12,200 (± 10%) <sup>c</sup>	6,000 (± 20%) <sup>c</sup>
Grain	8,100 (± 15%) <sup>c</sup>	8,000 (± 15%) <sup>c</sup>
Dry Beans	5,500 (± 15%) <sup>c</sup>	4,900 (± 15%) <sup>c</sup>
Other Crops	8,900 (± 15%) <sup>c</sup>	$7,100 (\pm 25\%)^{c}$
Total Irrigated Acreage	52,100 (± 5%) <sup>c,d</sup>	52,000 (± 5%) <sup>c,d</sup>

<sup>a</sup>Values are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: Department, Central District.

<sup>b</sup>Values are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: Department, Central District.

<sup>c</sup>Percentages obtained from SMWC.

dIncludes 5,500 double-cropped acres for 1995, and 4,900 double-cropped acres for 2020.

Figure 2-44 summarizes irrigated acreage by crop, on-field requirements, and TDRs.

In response to increasingly stringent limitations on burning, many of the Company's landowners flood a portion of their fields to clear their land of leftover rice straw by allowing the rice stubble to decompose. Approximately 4,000 to 10,000 acres have been flooded recently, a trend that may continue or increase assuming other options (including the sale of stubble for ethanol production) are not determined to be more economically feasible. Flood-related concerns currently considered by the Company may limit the total acreage potentially flooded for rice decomposition. This practice provides additional winter habitat for waterfowl above that which has been available within the Sacramento Valley since the development of agriculture.

Future irrigation season cropping patterns and associated water requirements are anticipated to change over time, but the total water requirements for the Company remain relatively the same as current conditions.

Urban.

Environmental.

Groundwater Recharge.

Topography and Soils.

Transfers and Exchanges. SMWC is one of 34 SRSCs that has participated in the Pool program. Since 1974 the Pool has been the forum to move available Project Supply supplies within certain years to other SRSCs. Each year, members participating in the Pool have the option to identify a quantity of their respective Project Supply that they wish to make

available to the Pool rather than for diversion. Within the Sutter Sub-basin SMWC has been one of the most active participators in the Pool; however, because of a reduction in contract water supply under the re-negotiated water contract, participation will be limited.

Other Uses. No other significant water uses other then those discussed above occur within SMWC.

#### 2.4.4.5 District Facilities

Diversion Facilities. SMWC operates four pumping plants in three locations on the Sacramento River: Tisdale Pumping Plant, State Ranch Bend Pumping Plant, and Portuguese Bend Pumping Plant. Company operations are coordinated with RD 1500 and PMWC to manage the supply and recapture/recycle system conveyance of. RD 1500 manages drainage within the SMWC service area. SMWC also supplies water to users in the RD 1660 area north of the Tisdale Bypass. Table 2-61 summarizes the primary SMWC surface water supply facilities. The Company does not own or operate any groundwater wells. Approximately 38 privately owned groundwater wells exist within the Company boundaries, but most have been curtailed or abandoned because of high salinity levels, lack of sustained yield, and readily available surface water supplies. See Figure 2-45 for a map of SMWC's major conveyance facilities.

Conveyance System. SMWC's distribution and conveyance system includes approximately 56 miles of irrigation water delivery canals and 144 miles of laterals. The Company service area's main distribution facilities include seven canals, listed in Table 2-62. The Main Canal supplies water from the Tisdale Pumping Plant to the West Canal, RD 1660 Main Canal, the Central Canal, and the East Canal. The State Ranch Bend Main Canal supplies water from the State Ranch Bend Pumping Plant to Lateral S and the West Side Canal. The Portuguese Bend Main Canal supplies water from the Portuguese Bend Pumping Plant to the southern end of the Company service area.

TABLE 2-62
SMWC Canals and Laterals
2009 Sacramento Valley Regional Water Management Plan Annual Update

Facility Name	Source Facility	Design Capacity (cfs)	Lined	End Spill Location	Percent Leakage Loss Estimate
Main Canal	Tisdale Pumping Plants	960	No	Reclamation Drain	15
East Canal	Main Canal	300	No	Reclamation Drain	15
Central Canal	Main Canal	300	No	Reclamation Drain	15
West Canal	Main Canal	300	No	Reclamation Drain	15
Portuguese Bend Main Canal	Portuguese Bend Pumping Plant	106	Portion	Reclamation Drain	15
State Ranch Bend	State Ranch Bend Pump Plant	128	No	Risers into drains along canals	15
1660 Main Canal	Main Canal	45	No	Risers into drains along canals	15

## Storage Facilities.

Spill Recovery. Drainage for SMWC is handled by RD 1500. The area is interlaced with drainage ditches that carry water towards the Reclamation District Main Drain and eventually out of the service area at the southern end of the Company via the RD 1500 Karnak Pumping Plant. The Company currently operates nine active drain recapture pumps, ranging in size from 12 to 70 cfs. The Company currently recaptures and recycles between 15,000 to 45,000 ac-ft/yr with these pumps.

## 2.4.4.6 Company Operating Rules and Regulations

## 2.4.4.7 Water Measurement, Pricing, and Billing

SMWC currently measures flows at the main pump stations using flowmeters and pump flowcharts. Flows at lateral headgates are measured using headgate position. Drain lift pump flows are measured using power consumption records and capacity information. Drainage leaving the Company is measured using a Department formula for the main drainage discharge pump station. Minor increases in conveyance efficiency could be achieved by increased operations measurement, with installation of measuring facilities along the main canal and at the heads of laterals. Any new operations measurement program should be integrated with the long-term operations automation program.

SMWC has in the past measured both the flow rate and the total quantity of water delivered at each turnout. Flow rates were measured using canal stage and turnout gate position. The volume of delivery was measured based on the flow rate and time of delivery (typically 24 hours). In recent years, the Company has provided water to its users on a per-acre per specified crop basis. SMWC's average on-farm efficiency of approximately 63 percent could potentially be increased through a combination of incentive pricing and on-farm improvements, providing some conservation savings. SMWC is participating in a water measurement study with other SRSCs to compare sub-basin and lateral level measurement to on-farm measurement. Table 2-62A presents an inventory of the Company's water measurement devices.

TABLE 2-62A
Agricultural Measurement Device Inventory for SMWC
2009 Sacramento Valley Regional Water Management Plan Annual Update

Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Concrete Large Weirs	15	+/-6-10%	Daily	NA	Yearly as needed
Measured Gates	357	+/-6-10%	Daily	Yearly or as needed	Yearly as needed
Measured Risers	14	+/-6-10%	Daily	Yearly or as needed	Yearly or as needed
Measured Checks	95	+/-6-10%	Daily	Yearly or as needed	Yearly or as needed
Total	481				

The intent is to demonstrate whether water purveyors need to measure water conveyance down to the on-farm level to accurately measure Company flows and deliveries. Preliminary indications are that sub-basin and lateral measurement is adequate for Company measurement and monitoring.

- 2.4.5 Pelger Mutual Water Company
- 2.4.5.1 History
- 2.4.5.2 Service Area and Distribution System
- 2.4.5.3 Water Supply

Surface Water.

**Settlement Contract Historical Diversions.** 

Non-contract Period (November – March). In addition to the contract water, PMWC has entitlements to pump water during the non-irrigation season for wetlands, rice straw decomposition and other irrigation demands. In response to increasingly stringent limitations on burning, some of the Company's rice growing landowners flood a portion of their fields to clear their land of leftover rice straw by allowing the rice stubble to decompose. Approximately 1,200 acres have been flooded in the past, a trend that is expected to continue or increase in the future.

#### Other Surface Water Sources.

**Groundwater**. The PMWC boundary overlies the Sutter Sub-basin (Department groundwater basin number 5-21.62) of the Sacramento Valley Groundwater Basin, and therefore within PMWC, occurs in a broad alluvial basin and is therefore not confined to any well-defined subsurface stream channels.

PMWC lies within the west-southern portion of the Sutter Sub-basin. The area is located on recent alluvial sediments including: channel, floodplain, basin, and alluvial deposits. Flood basin sediments are deposited in low-energy environments; therefore, they typically exhibit low permeabilities. Stream channel sediments are deposited in higher energy environments. Because they are coarser grained, these materials generally have high permeabilities. Underlying these recent fluvial deposits are the Tehama, Mehrten, and Laguna Formations (Department 1978; Department, 2003c).

In the Sutter Groundwater Sub-basin, the Tehama Formation interfingers with the Laguna and Mehrten Formations, forming the base of the continental deposits in this area. Although the Tehama Formation is mostly fine-grained, it contains sufficient sand and gravel zones in many areas to provide large quantities of groundwater. From its source area in the Coast Ranges, the Tehama Formation dips eastward beneath the valley floor (Department, 1978).

The Laguna Formation overlies the Mehrten Formation and is composed predominantly of fine-grained poorly sorted reddish to yellowish brown silt, clay, and sandy with local sand and gravel lenses (Page, 1980). The unit is highly variable ranging from predominantly silt with sandy lenses to sand with clay and silt lenses (Department, 1978). The Laguna formation was deposited as a westward thickening "wedge" on low-sloping alluvial fans by streams draining the Sierra Nevadas. Thickness ranges from 300 feet along the Sierra

Nevada foothills to as much as 1,000 feet near the Sacramento River (Department, 1978). Deposits of the Laguna Formation exhibit low to moderate permeability.

The Mehrten Formation includes both hard-gray tuff breccias derived from eruptions in the Sierra Nevadas and interbedded fluvatile volcanic silts, sands, and gravels (Department, 1978; Page, 1980). These deposits dip southwestward and range in thickness from 0 to 325 feet. While tuff breccias and clays yield little water and function as confining layers, the volcanic sands of the Mehrten Formation can yield large quantities to agricultural wells (Department, 2003c).

Groundwater quality in the Sacramento Groundwater Basin is generally good and sufficient for agricultural, domestic, and M&I uses. In general, natural groundwater quality is influenced by streamflow and recharge from the surrounding Coast Ranges and Sierra Nevada. Runoff from the Sierra Nevada is generally of higher quality than runoff from the Coast Ranges, because of the presence of marine sediments in the Coast Range. The northwest-trending Sutter Basin Fault creates water quality issues within the Sutter Subbasin (Department, 2003c). The fault may act as a conduit for the upward movement of connate water from deeper marine sediments. It has been reported that saline intrusion has displaced up to 2,000 feet of fresh water in the continental deposits, forming a mound of saline water in the east-central portion of the sub-basin. The total depth of fresh water in PMWC is approximately 1,200 feet bgs (Berkstresser, 1973). The fresh water is underlain by saline water.

Throughout PMWC groundwater movement is generally to the southeast, toward SMWC. The gradient is about 2 feet per mile. Limited recent groundwater data is available for the PMWC area; the Department monitors one well within the Company. Other monitoring wells are located within 2 miles of the Company boundary. Data has been collected discontinuously from these points from 1958 to 1980 (Department, 2003b). Examination of available data indicates that during years of normal precipitation, groundwater levels in the unconfined portion of the aquifer fluctuate between 4 and 6 feet seasonally; while during drought years, groundwater levels have been shown to fluctuate up to 8 feet (Department, 2003b). Wells located near recharge sources typically show less of an annual change in groundwater levels.

Past pumping and drought conditions have not historically negatively affected the overall long-term groundwater level trends in PMWC. Groundwater level data since 1980 from over 2,300 wells in the Sacramento Valley were reviewed and the historical trends show that groundwater levels in the PMWC area are generally stable over the long term, although short-term fluctuations in groundwater levels are observed that can be correlated with precipitation trends.

Since 1990, approximately 0 to 28 percent of the annual water requirements for the Company have been met by groundwater sources. Three privately owned wells are located within the Company's boundaries. These wells are used in conjunction with the river pumps and recycling pump to meet irrigation needs during drought periods. The total capacity of the three privately owned wells is approximately 26 cfs. PMWC does not own/operate any wells. PMWC is working with Sutter County, RD 1500, and SMWC to better define the local groundwater resource and is working with these entities to explore potential conjunctive management and groundwater monitoring opportunities.

## Other Water Supplies.

#### Water Use.

District Water Requirements. As noted above, PMWC is a relatively small Company serving just 10 landowners. However, due to climate and soils, the Company operates similarly to larger districts in terms of cropping patterns and cultural practices. Rice typically accounts for less than half of the Company's irrigated acreage on an annual basis; other key crops include tomatoes and corn (Department, Northern District). As is the case with most of the other districts, water requirements are typically highest during the summer months (July and August) due to the requirements of the crops grown within the PMWC boundary and the area's hot, dry climate.

Cultural practice water needs for rice are greatest early in the growing season associated with the flooding up of previously dry rice fields, as well as to meet the needs of other crops. Irrigation water requirements are met through the contract surface water supplies, drain recycling, and groundwater. There is high variability in crop mix from year to year. Associated water requirement needs and associated diversions have therefore been a function of water-year type, climate, and changes in crop mix.

Table 2-66 shows current (1995 normalized estimates) irrigated acreage estimates for the primary crops grown within the Company service area, as well as projections for 2020. The variation around these estimates (± percentage figures) was provided by the Company to account for typical variations in particular crop acreage (primarily due to year type), as well as anticipated future variation.

TABLE 2-66
PMWC Irrigated Acreage – 1995 and 2020 Estimates
2009 Sacramento Valley Regional Water Management Plan Annual Update

Crop	1995 <sup>a</sup>	2020 <sup>b</sup>
Corn	700 (± 10-25%) <sup>c</sup>	300(± 10-25%)°
Rice	600 (± 10-25%) <sup>c</sup>	1,200 (± 10-25%) <sup>bc</sup>
Tomatoes	600 (± 10-25%) <sup>c</sup>	300 (± 10-25%) <sup>c</sup>
Other Crops	1,000(± 10-25%)°	1,000 (± 10-25%) <sup>c</sup>
<b>Total Irrigated Acreage</b>	2,900 (± 10%) <sup>c,d</sup>	2,900 (± 10%) <sup>c,d</sup>

<sup>a</sup>Values are estimates derived from field data that have been normalized (data have been modified to simulate a condition where hydrology and climate are assumed to be normal, i.e., drought or wet condition assumed not to occur). Source: Department, Northern District.

<sup>b</sup>Values are future projections that incorporate current and historical trends, as well as anticipated local and regional development and economic trends in the year 2020. Source: Department, Northern District.

<sup>c</sup>Percentages obtained from PMWC.

dIncludes 100 double-cropped acres for 2020.

Figure 2-48 summarizes irrigated acreage by crop, on-field water requirements, and TDRs.

In response to increasingly stringent limitations on burning, some of the Company's ricegrowing landowners flood a portion of their fields to clear their land of leftover rice straw by allowing the rice stubble to decompose. Approximately 1,200 acres have been flooded in the past, a trend that is expected to continue and increase assuming other options (including the sale of stubble for ethanol production) are not determined to be more economically feasible. The Company currently has a verbal agreement with USFWS, which encourages winter straw decomposition flooding practices. This practice provides additional winter habitat for waterfowl above that which has been available within the Sacramento Valley since the development of agriculture.

Future irrigation season cropping patterns and associated water requirements are anticipated to vary widely, as shown by the historical data.

Urban.

Environmental.

Groundwater Recharge.

Topography and Soils.

Transfers and Exchanges.

Other Uses.

District Facilities.

## 2.4.5.4 District Operating Rules and Regulations

## 2.4.5.5 Water Measurement, Pricing, and Billing

PMWC currently measures flows at the main pump stations using flowmeters. Flows at lateral headgates are measured using headgate position. Drain pump flows are measured with meters. The three wells each have flowmeters installed. Review of the Company's records for the last ten seasons indicates that the existing water measurement program is very effective in matching supply and demand and accounting for the flow of water at key points in the system. The average deficit between supply into the distribution system and delivery to field turnouts is approximately 15 percent, which is largely accounted for by estimated leakage losses. No beneficial improvements are identified for the Company's water measurement program.

PMWC currently measures the flow rate and the total quantity of water delivered at each turnout. Flow rates are measured using canal stage and turnout gate position. The volume of delivery is measured based on the flow rate and time of delivery. The Company's average on-farm efficiency of approximately 80 percent, estimated using the Department crop consumptive use data and Company field delivery data, is near the upper practical limit for the crop types and irrigation methods in the service area. There is no significant potential for efficiency savings by use of flowmeters at turnouts. Table 2-71A presents an inventory of the Company's water measurement devices.

#### TABLE 2-71A

Agricultural Measurement Device Inventory for PMWC

2009 Sacramento Valley Regional Water Management Plan Annual Update

Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Weirs	7	+/-5%	30	NA	Yearly
Metered Gates	18	+/-5%	Daily	Monthly	Monthly
Total	25				

Billing for water is made on a monthly basis in equal installments May-September. Rate costs are by crop per acre (example: rice=\$75.00 per acre). Rates are established at PMWC annual meetings held in March of each year. The water master measures water at each turnout and totals water uses by month. A report of measured water pumped and delivered is made available to the shareholders each year after the irrigation season. In addition to water charges for irrigation there is established a Maintenance Assessment of \$15.00 per acre.

# 2.5 American Sub-basin

- 2.5.1 Water Supply within the American Sub-basin
- 2.5.2 Water Use within the American Sub-basin
- 2.5.3 Natomas Central Mutual Water Company

## 2.5.3.1 History

NCMWC (or the Company) was organized under the California Irrigation District Act of 1897. The Company entered into a negotiated agreement with Reclamation in 1964, quantifying the amount of water it would divert from the Sacramento River. The resulting negotiated agreement recognized NCMWC's annual entitlement to a Base Supply of 98,200 ac-ft/yr of flows from the Sacramento River and also provided for a 22,000 ac-ft allocation of Project Supply, resulting in a total contract entitlement of 120,200 ac-ft/yr. The schedule of monthly diversions of the Contract Total, Base Supply, and Project Supply are identified in Exhibit A to the Settlement Contract for NCMWC, and is included in Table 2-72. The Settlement Contract negotiated in 1964 was renewed in March 2006, and run until March 2045.

In addition to the contract water, NCMWC has entitlements to divert Sacramento River water during the nonirrigation season for wetlands and rice straw decomposition. There are approximately 61 privately owned wells and two NCMWC-owned wells within its boundaries. These wells are used in conjunction with the river pumps and recycling pump to meet irrigation needs on an as-needed basis. Rice is the predominant crop grown within the Company boundaries, in addition to sugar beets and grain.

#### 2.5.3.2 Service Area and Distribution System

NCMWC is located on the east side of the Sacramento River between the towns of Knights Landing and Sacramento in the Counties of Sutter and Sacramento within the southern portion of the American Basin. NCMWC's service area encompasses approximately

55,000 acres, which includes approximately 36,000 acres that are typically irrigated. The Company serves approximately 280 landowners. The Company's service area includes the Sacramento Municipal Airport and several residential developments, which are proposed in response to continued growth within and adjacent to the Sacramento area. NCMWC has three main pump stations located on the Sacramento River: Prichard Lake Pumping Plant, Riverside Pumping Plan, and Elkhorn Pumping Plant. The Company also diverts water from the Natomas Cross Channel, which is located along the northern boundary of the Company. Diversion waters from the Cross Channel subsequently flow from north to south, and water diverted from the Sacramento River flows generally flow from west to east or south.

## 2.5.3.3 Water Supply

Surface Water. The NCMWC surface water supply entitlement is currently addressed in a contract with Reclamation entered into in 2006, Contract No. 14-16-200-0885A-R-1 (Contract No. 0885A-R-1). This contract provides for an agreement between NCMWC and the United States on NCMWC's diversion of water from the Sacramento River during the period April 1 through October 31 of each year.

Contract No. 0885A-R-1 provides for a maximum total of 120,200 ac-ft/yr, of which 98,200 ac-ft is considered to be Base Supply and 22,000 ac-ft is CVP water (Project Supply), as shown in Table 2-74. The contract also provides that additional Project Supply can be purchased if surplus water is available.

Settlement Contract Historical Diversions.

Non-contract Period (November - March).

Other Surface Water Sources.

Groundwater.

Other Water Supplies. In recent years, NCMWC has relied heavily upon tailwater as an alternate supply to its Sacramento River entitlement. The source of this tailwater has been primarily from inside of the Company, although some tailwater is available from the lands on the western edge of the Company which are adjacent to the Sacramento River (approximately 7,000 acres). High groundwater levels in much of the Company service area also contribute inflow to the drains. Approximately 35,000 ac-ft of tailwater are used annually. Continued reuse and recycling efforts are expected to be influenced by an increasing need to manage salinity, pH, and other constituents that affect crop productivity and sustainability.

The Company completed the installation of a recirculation system in 1986, to improve water quality for the City of Sacramento and increase overall efficiency within the Company boundaries. The recirculation system has since provided for the following benefits:

- Improve water quality discharge from RD 1000 pumping plants into the Sacramento River.
- Reduce pumping during the summer months by RD 1000, thus reducing their operation costs.

- Increase water availability to parts of service area with a history of "poor service."
- Reduce costs to customers (drain rate) who install drain pumps to receive tailwater exclusively.
- Reduce diversions and water costs paid (Restoration Fund) for Project Supply.
- Improve water conservation practices through the installation and operation of a Companywide recycling program.
- Allow greater flexibility for growers in method and timing of water application and crop selection without the implementation of a metered water charge system.

The recirculation system includes 30 pumping stations at various locations that recapture water for reuse either directly into fields or back into the main irrigation canals. During a normal irrigation season, no agricultural drainage water returns to the Sacramento River until after the end of the rice irrigation season (between August 15 and September 1).

#### 2.5.3.4 Water Use

District Water Requirements. Rice is the overwhelmingly predominant crop grown within NCMWC's service area. Other crops include tomatoes and sugar beets, in addition to rotation crops such as wheat and safflower, which are rotated with rice and tomatoes. Rice typically accounts for approximately 70 to 75 percent of the Company's irrigated acreage on an annual basis. Agriculture in NCMWC is under increasing pressure to convert to urbanized, residential use in the face of growth in the greater Sacramento region. Additionally, some of the urban developments, such as the airport, use Company water for ornamental landscaping, truck gardens, and fruit stands.

As is the case with most of the other water providers, water requirements are typically highest during the summer months (July and August) due to the requirements of rice and the area's hot, dry climate. Cultural practice water needs for rice are greatest early in the growing season associated with the flooding up of previously dry rice fields, as well as to meet the needs of other crops. The vast majority of irrigation water requirements are met through the contract surface water supply, although groundwater is used in drought years on an individual grower basis, as well as per agreements with the Company. Annual cropping patterns have remained fairly constant over the last few decades, other than in response to farm programs in the early 1980s. Associated water requirement needs and associated diversions have therefore been more a function of water-year type and climate than changes in cropping.

Table 2-75 shows current (1995 normalized estimates) irrigated acreage estimates for the primary crops grown within the Company service area, as well as projections for 2020. The variation around these estimates (± percentage figures) was provided by the Company to account for typical variations in particular crop acreage (primarily due to year type), as well as anticipated future variation.

Figure 2-55 summarizes irrigated acreage by crop, on-field water requirements, and TDRs.

In response to increasingly stringent limitations on burning, some of the Company's rice-growing landowners flood a portion of their fields to clear their land of leftover rice straw by allowing the rice stubble to decompose. Approximately 5,780 acres were flooded in 1999 and 6,700 acres were flooded in 2004, a trend that is expected to continue or increase, assuming other options (including the sale of stubble for ethanol production) are not determined to be more economically feasible. This practice provides additional winter habitat for waterfowl above that which has been available within the Sacramento Valley since the development of agriculture.

#### Urban.

Environmental. Company lands are currently not included in the Natomas Basin Habitat Conservation Plan that has been prepared to address long-term habitat needs for the giant garter snake, the American peregrine falcon, the valley elderberry longhorn beetle, and multiple other state- and federal-listed or threatened species. The preparation of the Natomas Basin Habitat Conservation Plan underscores the continuing resource agency concern with the continued urban development of lands within the NCMWC service area, which currently provide valuable habitat for a number of sensitive species. Adoption and implementation of this habitat conservation plan has placed additional constraints on both agricultural and M&I water use, including deliveries of water in the winter and cropping requirements. However, implementation of the Natomas Basin Habitat Conservation Plan is expected to limit the amount of additional Company lands that could be converted to urban use.

Approximately 635 acres of riparian vegetation are estimated to be incidentally supplied by irrigation, including vegetation directly adjacent to delivery laterals or influenced by leakage from the delivery system. Such vegetation includes habitat used by the federally listed giant garter snake and other species that use such habitat as discussed above.

Up to 6,700 acres of rice stubble were flooded in 2004, with associated winter habitat benefits to migratory waterfowl that use the area as part of the Pacific Flyway. The flooding of rice fields in the spring and summer provides wetlands habitat during these periods for waterfowl and terrestrial species. Rice fields that are not flooded also provide habitat for waterfowl and upland birds as resting areas. Of these lands, the Natomas Basin Conservancy manages approximately 1,031 acres of environmental or wetlands areas within the Company. By 2020 is anticipated that NCMWC will have 2,500 acres of managed marsh/wetlands, and an additional 4,500 acres of agricultural land owned and operated by the Natomas Basin Conservancy.

Groundwater Recharge.

Topography and Soils.

Transfers and Exchanges.

Other Uses.

District Facilities

Diversion Facilities. NCMWC has three main pump stations located on the Sacramento River: Prichard Lake Pumping Plant, Riverside Pumping Plant, and Elkhorn Pumping Plant. NCMWC also diverts water from the Cross Canal at the Northern and Bennett Pumping Plants. The Cross Canal is located along the northern boundary of the service area. Diversions from the Cross Canal generally flow from north to south; water diverted from the Sacramento River generally flows east or south. Table 2-76 summarizes these surface water supply facilities. A separate 75-cfs capacity pump at the Elkhorn Pumping Plant supplies landscape irrigation water for the Sacramento Metropolitan Airport. See Figure 2-56 for a map of NCMWC's major conveyance facilities.

The Company owns groundwater wells, which are rarely used for water supply.

Conveyance System.

Storage Facilities.

Spill Recovery. NCMWC is drained by four main drainage canals: Natomas East Main Drainage, North Drainage, East Drainage, and West Drainage Canals. The Natomas East Main Drainage Canal drains directly into the Sacramento River, just north of its confluence with the American River. The West Drainage Canal and the East Drainage Canal join in the south and drain to the Sacramento River in the southern portion of the Company via a drain pump. In addition, the Company completed the installation of a recirculation system in 1986 to increase water quality for the City of Sacramento and increase overall efficiency of the Company. The recirculation system includes 30 pumping stations at various locations that recapture for use either directly onto fields or back into the main irrigation canals. Tables 2-78 and 2-79 summarize the main NCMWC drainage facilities.

TABLE 2-78
NCMWC Drain Pump Stations
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			Capacity	Average Historical Pumping Total
Pump Station ID	Source	Discharges To	(cfs)	(ac-ft/yr)
Snake Ditch Pump	Main Drainage Canal	Snake Ditch	N/A	N/A
San Juan 30 Horse Pump	San Juan Horse Ditch	San Juan Lateral	N/A	N/A
Plant No. 13 Pumps	West Drainage Canal	No. 13	N/A	N/A
Plant No. 8 Pumps	E Drainage Canal	H Road Lateral	N/A	N/A
E Drain Pumps	Lateral of E Drainage Canal	East Drain	N/A	N/A
T-Drain Pump	T-Drain	Northern Main	N/A	N/A

Note:

N/A = not available

TABLE 2-79 NCMWC Drainage Laterals

2009 Sacramento Valley Regional Water Management Plan Annual Update

Name	End Spill	Downstream Diverters/Recapture
T-Drain	Northern Main Canal	N/A
North Drainage Canal	H1/Pullman Pumps	N/A
E Drainage Canal	Natomas E Main Drainage Canal	N/A
Airport Drain	West Drainage Canal	N/A
West Drainage Canal	Fisherman's Lake/Natomas Main Drainage	N/A
Fisherman's Lake	West Drainage Canal	N/A
San Juan 30 Horse Ditch	West Drainage Canal	N/A
Natomas E Main Drainage Canal	RD 1000 Pumping Plant	N/A

Note:

NA = not applicable

During the growing season, drains are managed by NCMWC to deliver water. RD 1000 manages the in the off season (after October 1), when most drainage is returned to the Sacramento River.

## 2.5.3.5 District Operating Rules and Regulations

## 2.5.3.6 Water Measurement, Pricing, and Billing

NCMWC measures water at its five Sacramento River diversion pump stations using flowmeters provided by Reclamation. No flow measurements are taken and recorded internally on any of the main canals or laterals. Adjustments to water flows for delivery purposes are made manually, using a method of approximation. This method is highly labor intensive but has proven successful for improving water management.

The Company's internal drain pumps and secondary lift pumps are not equipped with any type of measuring device. Delivered water volumes from these facilities are estimated based on power consumption and pump efficiency data. This method is also used to estimate the outflow amounts from RD 1000's drainage pumps into the Sacramento River. Only RD 1000 has the ability to discharge water back into the river. Table 2-79A presents an inventory of the Company's water measurement devices.

TABLE 2-79A
Agricultural Measurement Device Inventory for NCMWC
2009 Sacramento Valley Regional Water Management Plan Annual Update

Measurement Type	Number	Accuracy (+/-percentage)	Reading Frequency	Calibration Frequency	Maintenance Frequency
Acoustic Doppler	3	+/-5	Monthly	Yearly	Yearly
Propeller	2	+/-10	Monthly	Yearly	Yearly
Total	5				

Through the installation and use of flow measuring devices on its internal pumping plants and in the main canals and laterals, the Company believes there is potential for some level of improved management. It is possible that water savings might occur by eliminating excess water usage through measured water deliveries. These improvements would complement the automation improvements discussed in the previous section.

NCMWC does not meter individual customer turnouts. The Company's current water rate structure does not require the field staff to measure and record the total quantity of water delivered to each turnout. Its rate structure is an annual flat rate, per-acre charge for rice and wild rice crops, with a modified, annual flat rate, per-acre charge for other crops. The modified flat rate varies according to the number of times water is applied to a crop. Crops applying water more often are charged more per acre (unrelated to measurement). The Company also provides a discount to growers extracting their own irrigation water from the drains.

Field measurement and quantification, in combination with an appropriate incentive pricing structure and on-field improvements, may increase the average on-farm efficiency. The effective implementation of such a program would depend on optimal combination of the above components, in addition to basic economic considerations such as the return on investment to the Company and landowners. However, the overall NCMWC efficiency is high and, therefore, it is questionable what benefits are gained from increasing on-farm efficiency.

The installation, maintenance, and reading of meters for the nearly 400 turnouts would represent a prohibitively expensive capital cost to the Company, as well as the assumption of ongoing labor and capital expense. Improved measurement and quantification of deliveries may be possible with improved water level control, as discussed above. This would allow the Company's field staff to begin recording start/stop times and average flow rates for each delivery order.

#### **SECTION 3.0**

# Regional Water Measurement Program

<u>Section 3.0 revisions to the RWMP are highlighted below in shaded text. An update on the status of the Cooperative Measurement Study was completed.</u>

# 3.1 Plan Identification

As stated in Reclamation's Regional Criteria (Reclamation, 2004):

Each Participating contractor shall implement one of the following measurement options:

- 1. Fully measure with a reasonable degree of accuracy the volume of water delivered by each Participating contractor to each of its respective customers, and implement procedures that provide incentives for improved management of water within 5 years of contract renewal; or
- 2. Implement a mutually acceptable water measurement program (including timeframes and budget needs) within 3 years of the renewal of the Participating contractors' contract with Reclamation, with full Implementation within 5 years thereof. This option should be at least as effective as option 1 and will be substantiated based on field documentation derived from the measurement study(s) conducted in relevant Sub-regions. Please attach a description of the study(s) including the study objectives, along with an estimated timeline and budget.

The participating SRSCs will implement the second option. The first phase of this program is titled the Cooperative Water Measurement Study Work Plan, which was funded by Reclamation, completed in 2003, and is included as Appendix B.

The next phase of the Cooperative Study is funded partially through Chapter 7 Proposition 50 funds for the CALFED Water Use Efficiency Program (Section B Agricultural Research and Development Projects), and partially by a Reclamation Water Conservation Field Service Program Grant. Coordination of participants and preparation of Cooperative Study components have been ongoing since January 2006. Field study began at the start of the 2006 irrigation season. All Cooperative Study elements are described below.

# 3.2 Cooperative Water Measurement Study Measurement Plan Evaluation

The current phase of the Cooperative Study is evaluating the appropriate level of intradistrict measurement. As described below, continued demands on the state's finite water resources require that water be used in as efficient a manner as possible. The joint state-federal CALFED program, specifically with respect to the Ag WUE, is working to fund and sponsor research to address the question of appropriate measurement in terms of location, method, cost, and necessity. The Cooperative Study will support this subprogram and will add to the body of knowledge currently being developed across the state. The Cooperative Study components were largely completed after the end of the 2007 irrigation season. Since that time, efforts have been focused on documentation and conclusions of the study.

#### The Cooperative Study consists of three major components:

- Field Measurement Study
- Water Management and Measurement Interviews
- Delivery Data Analysis

The Field Measurement Study involved the installation of water measurement instruments on laterals and turnouts of two selected acreages within RD 108. Field data collected over 2 years was analyzed to compare measurement at the lateral level, turnout level, and district-wide level to provide insights to the issue of appropriate agricultural water measurement.

Water interviews were performed in 2006 and 2007 to document the numerous factors involved in water delivery decisions, management of the water supply, water measurement practices, and perceptions of water measurement. Interview participants included general managers, field superintendents, field operators, growers, and Board members. Four districts agreed to participate in this component of the Cooperative Study: SMWC, GCID, RD 1004, and RD 108. Although the SRSCs have unique physical and policy characteristics, interviewing these four was conducted to provide a better understanding of current practices that could be observed through most of the Sacramento Valley.

For the Delivery Data Analysis, two districts where chosen, RD 1004 and SMWC. RD 1004 was chosen because of the transition in 1994 of their charging structure from a "flat rate" per-acre basis to a per-ac-ft basis. This required volume delivered to be measured at each turnout. SMWC was chosen because they shifted from a per-ac-ft billing structure as measured at each turnout, to a flat rate basis according to the crop and acreage, although volume delivered is still measured at a turnout level.

In addition to evaluating methods of improving water management, the BWMP was used to form a basis for the renewal of the SRSCs' CVP contracts with Reclamation. This Cooperative Study will support the SRSCs and Reclamation in developing a mutually agreeable surface water delivery water measurement program that will be consistent with the proposed regional criteria as part of each of the contracts. To be consistent with regional criteria and to be mutually agreeable to Reclamation, the following questions were identified by Reclamation as part of the Work Plan development:

- 1. What are the most cost-effective measurement methods that will work satisfactorily under the conditions of the SRSCs' service areas?
- 2. What are the benefits that are derived from measurement at turnout, lateral, and district levels? Are there potential issues/benefits of pricing water by volume measured at the turnout or customer level?
- 3. Based on information gained from questions 1 and 2, what are the benefits and costs associated with measurement at the sub-basin, district, lateral, and turnout levels?

The Cooperative Study addressed these questions while also supporting the requirements of the proposed regional criteria. The regional criteria make reference to measurement at the customer level within the contractor service area. The study investigated several levels of measurement, including field-level (turnout-level), which is used interchangeably with customer-level.

# 3.3 Plan Selection

Cooperative Study data and analysis results were distributed to Reclamation, participating districts, other BWMP participants, and the Cooperative Study funding agencies in the form of a progress report at the end of the first year of the study and a final report to be completed in mid-2010. The study results will provide science-based information for the issue of water measurement in the Sacramento Valley.

# 3.3.1 Year 1 (2006) Progress Report

A progress report after Year 1 (2006) presented initial study data, preliminary analyses, and study accomplishments. This report documented study refinements intended to be beneficial for the second year of the study.

- **Field Study** The refinement identified for the field study after Year 1 was to install lateral-level Sontek acoustic-doppler water measurement devices at the upstream and downstream ends of the main supply lateral supplying the study area. These additional devices allowed for another level of water measurement to compare to planned measurement locations. Reclamation installed and maintained the two Sontek meters, and provided the measurement data to the study team for analysis with other data for study conclusions.
- **Delivery Data Analysis** Refinements were also necessary to implement the delivery data analysis portion of the Cooperative Study. Because of the lack of delivery data prior to the change in pricing policy at RD 1004, and a lack of diversion data from sources other than the Sacramento River, the analysis was eliminated from study in Year 2. The data issues encountered at RD 1004 were documented in the final report.

# 3.3.2 Final Report

Following Year 2 (2007), a draft final report was prepared that summarized the purpose and accomplishments of the study, and addressed the three basic questions described in Section 3.2. The draft final report was in development throughout 2008, with reviews and revisions coordinated with the SRSCs and Reclamation. The final report is expected to be complete in mid-2010; it will include study data and analysis of the field data, existing delivery data, interviews, and other information collected. An evaluation of the equipment used, including the field performance, ease of operation, and durability, is also included in the final report. The report also summarizes the total costs of measuring agricultural water supply at various operational levels and including the associated labor costs of downloading and managing flow data.

# 3.3.3 Cooperative Study Conclusions Overview

Conclusions of the Cooperative Study were developed in conjunction with BWMP participants and Reclamation with input from third-party expert reviewers. All study conclusions will be documented in the final report. One of the primary conclusions is that while the study did develop a wide range of information and analyses on the issue of appropriate water measurement for the BWMP participants, it was also a significant step towards establishing a mutually acceptable water measurement program. Additional study and analysis in a cooperative manner is likely required to formalize an acceptable

measurement program. A summary of additional conclusions developed in the Cooperative Study are provided below.

Effective water measurement can provide the following benefits, depending on the ability to access the measurement data:

- Facilitate contract compliance
- Provide a tool for daily or hourly operations
- Assist in maintaining proper head and flow in laterals
- Provide for equitable apportionment of flow between growers
- Provide implementation of district or company pricing policies
- Assist with grower delivery decisions

The Cooperative Study documented the cost of measuring at the turnout level for a small percentage of SRSC service acreage farmed to rice. Considering purchase, installation, routine maintenance, and data management, the average cost of a single turnout propeller meter for the first year of operation is typically \$2,500 to \$4,000, with annual costs in the range of \$600 to \$800 per meter thereafter. Some SRSCs have over 3,000 turnouts, making districtwide turnout-level measurement a major cost. Additionally, fields might vary significantly in size, resulting in a wide range of cost when viewed on a per-acre basis. For example, using the average costs identified above, the annual cost per acre for the fields included in the Field Measurement Study would range from approximately \$5.00 per acre to over \$10.00 per acre. Such a significant investment would require more analysis of quantifiable benefits and beneficiaries.

Regarding the appropriate level of water measurement, the following conclusions were drawn from the components of the Cooperative Study:

- Water measurement at both the district level and lateral level are appropriate levels of
  water measurement. District-level measurement (diversions at the Sacramento River) are
  required by contract and carried out by Reclamation. Lateral-level measurement is
  currently in use in various forms by all of the SRSCs.
- The feasibility and appropriateness of water measurement at the turnout level is highly dependent on crop type, irrigation system infrastructure, irrigation operations, and purpose of measurement. The Cooperative Study found that accurate measurement at individual turnouts to rice fields (which is the predominant crop for all districts that participated directly in the study and the RWMP) is difficult, costly, and not the best water management tool available for most service areas, regardless of the equipment used.
- In many SRSC service areas, system reconfiguration would be required for accurate turnout-level water measurement. Accurate turnout-level measurement is dependent on some head drop through the turnout, which maintains velocities within the rated range of the device and high enough to eliminate sediment accumulation. Much of the land used to grow rice within the service areas participating in the Cooperative Study is located in low-lying areas of districts (e.g., RD 108). Improving measurement accuracy would, in many areas, require an extremely costly, and, in most cases, economically or logistically infeasible reconfiguration of the delivery system to increase head.

#### **SECTION 4.0**

# Analysis of Sub-region Water Management Quantifiable Objectives

<u>Section 4.0 revisions to the RWMP are highlighted below in shaded text.</u> A re-evaluation of TBs applicable to each SRSC and identification/summary of all actions to meet QOs for each applicable TB was completed. The list of quantifiable objectives presented in Table 4-1 includes all projects identified to date within each sub-basin by individual SRSCs. The next update will identify all proposed projects and associated QOs by TB.

# 4.1 Development of CALFED Targeted Benefits

- 4.2 Participating Sacramento River Settlement Contractor Identification of Applicable Targeted Benefits and Associated Quantifiable Objectives
- 4.2.1 Sacramento River Basinwide Water Management Plan
- 4.2.2 Sacramento Valley Water Management Agreement and Program
- 4.2.3 Development of Quantifiable Objectives
- 4.2.4 Redding Sub-basin
- 4.2.4.1 Identification of Applicable Targeted Benefits
- 4.2.4.2 Determination of Non-applicability

Anderson-Cottonwood Irrigation District.

Current Activities for ACID Quantifiable Objectives.

Potential ACID Quantifiable Objectives.

- 4.2.5 Colusa Sub-basin
- 4.2.5.1 Identification of Applicable Targeted Benefits
- 4.2.5.2 Determination of Non-applicability

Glenn-Colusa Irrigation District.

Princeton-Codora-Glenn Irrigation District.

Provident Irrigation District.

Reclamation District No. 108.

## 4.2.6 Butte Sub-basin

- 4.2.6.1 Identification of Applicable Targeted Benefits
- 4.2.6.2 Determination of Non-applicability

Reclamation District No. 1004.

- 4.2.7 Sutter Sub-basin
- 4.2.7.1 Identification of Applicable Targeted Benefits
- 4.2.7.2 Determination of Non-applicability

**Sutter Mutual Water Company.** 

Pelger Mutual Water Company.

Meridian Farms Water Company.

- 4.2.8 American Sub-basin
- 4.2.8.1 Identification of Applicable Targeted Benefits
- 4.2.8.2 Determination of Non-applicability

Natomas Central Mutual Water Company.

TABLE 4-1 Summary of Applicable Targeted Benefits and Proposed Actions 2009 Sacramento Valley Regional Water Management Plan Annual Update

				CALFED			Maximum Contribution to QO from	Locally Beneficial				
Targeted Benefit	Analyze	Priority	Implement	Sub- region	Participating SRSCs	Proposed Action	Proposed Action (ac-ft)	Portion of Action <sup>a</sup>	Action-specific Monitoring Plan	Funding Sources		
6) In-stream flow benefit in Sacramento River	2005	2005	2008	1	ACID	Construct pipeline to replace	8,700	\$5,000	Action-specific monitoring	Prop 50 award of \$144,000		
7) Decrease nonproductive ET						leaky canal lateral			plan will be included in construction contract	June 2005, for feasibility study		
6) In-stream flow benefit in Sacramento River	2005	2005	2009	1	ACID	Reduce spill through system	20,000	\$20,000	Action-specific monitoring	Prop 50 award of \$1.775 million		
8) Provide long-term diversion flexibility						automation			plan will be included in construction contract	June 2005, for Phase 1 of construction		
6) In-stream flow benefit in Sacramento River	2005	2005	2007	1	ACID	Construct four groundwater	6,800	\$318,000	Well output will be monitored	Submitted for Prop 50, Chapter 8		
8) Provide long-term diversion flexibility						extraction wells				funding for Integrated Regional Water Management		
6) In-stream flow benefit in Sacramento River				1	ACID	Replace existing canal creek crossing with new siphon beneath Olney Creek	2,100	TBD	Action-specific monitoring plan will be included in construction contract	TBD		
4) Remove flow impediment in Cottonwood Creek				1	ACID	Remove and replace siphon segment crossing beneath Cottonwood Creek	ł	TBD	Action-specific monitoring plan will be included in construction contract	Submitted for U.S. Fish & Wildlife Service Anadromous Fish Restoration Program funding in June 2008		
20) In-stream flow benefit in Sacramento River	2005	2005	2008	3	GCID	Design and construct 12 flow measurement devices and 5	40,000	\$408,000 <sup>b</sup>	Action-specific monitoring plan will be included in	Submitted for partial funding from		
<b>26, 27, and 29)</b> Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands						Main Canal check structures			construction contract	Prop 50, Chapter 8 funding for Integrated Regional Water Management		
20) In-stream flow benefit in Sacramento River	2005	2005	2007	3	GCID	Construct 10 groundwater	27,300	\$761,000	Well output will be monitored	Submitted for Prop 50, Chapter 8		
<b>26, 27, and 29)</b> Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands						extraction wells				funding for Integrated Regional Water Management		
20) In-stream flow benefit in Sacramento River	2005	2005	TBD	3	GCID	Construct 30,000 to 40,000 ac-ft	50,000	\$51,000	Action-specific monitoring plan will be included in	Prop 50 award of \$257,000 June 2005		
21, 22, and 23) Reduce pesticides						regulating reservoir on Colusa Basin Drain			construction contract	Julie 2005		
<b>26, 27, and 29)</b> Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands												
20) In-stream flow benefit in Sacramento River				3	GCID	Measure GCID drainwater outflow to reduce tailwater spills	20,000	\$100,000	Monitor flows to reduce spills	Reclamation Water Conservation Grant in June 2007		
<b>26, 27, and 29)</b> Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands						outnow to reduce tanwater spins				Grant in June 2007		
20) In-stream flow benefit in Sacramento River	2005	2005	2006	3	RD 108	Replace five flashboard checks with combination ITRC flap gate	2,000	\$600,000	Action-specific monitoring plan will be included in	Reclamation Water Conservation Grant will provide \$300,000; the		
<b>26, 27, and 29)</b> Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands						and ramp flumes			construction contract	remaining \$300,000 will be funded by RD 108		
20) In-stream flow benefit in Sacramento River	2005	2005	2007	3	RD 108	Install up to five production wells	8,000	\$340,000	Well output will be monitored	Submitted for Prop 50, Chapter 8		

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TABLE 4-1 Summary of Applicable Targeted Benefits and Proposed Actions 2009 Sacramento Valley Regional Water Management Plan Annual Update

				CALFED		Maximum Contribution to Locally QO from Beneficial Proposed Action Portion of Action-specific				
Targeted Benefit	Analyze	Priority	Implement	Sub- region	Participating SRSCs	<b>Proposed Action</b>	Proposed Action (ac-ft)	Action of	Action-specific Monitoring Plan	<b>Funding Sources</b>
<b>26, 27, and 29)</b> Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands						for groundwater management program				funding for Integrated Regional Water Management
<b>26</b> , <b>27</b> , <b>and 29</b> ) Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands				3	RD 108	Characterize the groundwater system underlying the northern portion of the district		\$31,000	Collect and organize groundwater data to develop information	AB303 program and Prop 84 grant
20) In-stream flow benefit in Sacramento River				3	RD 108	Increase capacity of recycled	15,000	\$500,000	Monitor flows and salinity	Prop 50 Grant
24) Reduce salinity in Colusa Basin Drain						water			levels to reduce spills and salt concentration	
<b>26, 27, and 29)</b> Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands										
20) In-stream flow benefit in Sacramento River				3	RD 108	Improve operations of recycled	4,000	\$50,000	Monitor flows and salinity	Reclamation Water Conservation
24) Reduce salinity in Colusa Basin Drain						water			levels to reduce spills and salt concentration	Field Services Grant will provide \$50,000; the remaining \$50,000 will
<b>26, 27, and 29)</b> Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands										be funded by RD 108
20) In-stream flow benefit in Sacramento River	2005	2005	2007	3	PCGID	Develop a conjunctive water	5,000	$TBD^c$	Well output will be monitored	PCGID will fund the program with
<b>26</b> , <b>27</b> , <b>and 29</b> ) Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands						management program				District monies
20) In-stream flow benefit in Sacramento River	2005	2005	2007	3	PID	Develop a conjunctive water	5,000	$TBD^c$	Well output will be monitored	PID will fund the program with
<b>26, 27, and 29)</b> Provide long-term diversion flexibility for wetlands, salt-affected soils, and other suitable lands						management program				District monies
30) In-stream flow benefit in Sacramento River	2005	2005	2008	4,5	RD 1004	Line canal	7,500	\$120,000 <sup>b</sup>	Action-specific monitoring	Funding will be pursued through
33) Decrease nonproductive ET									plan will be included in construction contract	future rounds of Water Use Efficiency Grant Funding
36) Provide long-term diversion flexibility										
30) In-stream flow benefit in Sacramento River	2005	2005	2006	4,5	RD 1004	Construct two groundwater	5,000	\$40,000 <sup>b</sup>	Well output will be monitored	Submitted for Prop 50, Chapter 8
33) Decrease nonproductive ET						extraction wells				funding for Integrated Regional Water Management
<b>34, 35, 47, and 48)</b> Provide long-term diversion flexibility to increase water supply for beneficial use of wetlands and other suitable lands										
30) In-stream flow benefit in Sacramento River				4,5	RD 1004	Remove and replace White Mallard Dam and fish ladder on	17,000	\$25,000	Creek diversion will be	First phase funded by Ducks Unlimited at \$1.4 million; second-
33) Decrease nonproductive ET						Butte Creek; install weir and fish			monitored	phase funding of \$4 million sought
37) In-stream flow benefit in Butte Creek						screen				through Ducks Unlimited

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TABLE 4-1 Summary of Applicable Targeted Benefits and Proposed Actions 2009 Sacramento Valley Regional Water Management Plan Annual Update

2007 Sacramento valley Regional Water Wahageme	TICT TOTAL MITTUO	и ориан					Mayim			
				CALFED Sub-			Maximum Contribution to QO from Proposed Action	Locally Beneficial Portion of	Action-specific	
Targeted Benefit	Analyze	Priority	Implement	region	Participating SRSCs	Proposed Action	(ac-ft)	<b>Action</b> <sup>a</sup>	Monitoring Plan	Funding Sources
30) In-stream flow benefit in Sacramento River				4,5	RD 1004	Upgrade field-level flowmeters	1,600	\$67,500	Field-level turnouts will be monitored allowing RD 1004	Individual farmers paid for initial flowmeters at approximately \$1,000
33) Decrease nonproductive ET									to charge water users by the	each in 1992; upgrades cost an
<b>34, 35, 47, and 48)</b> Provide long-term diversion flexibility to increase water supply for beneficial use of wetlands and other suitable lands									ac-ft	estimated \$67,500; and meter maintenance, estimated at \$7,000 /year, is paid for by the District
37) In-stream flow benefit in Butte Creek										
30) In-stream flow benefit in Sacramento River				4,5	RD 1004	Rebuild recirculation pump	3,800	\$63,200	Lift pump that recycles	Funded by RD 1004 at a cost of
<b>34 and 35)</b> Provide long-term diversion flexibility to increase water supply for beneficial use of wetlands and other suitable lands									drainage water will be monitored	\$63,200
37) In-stream flow benefit in Butte Creek										
30) In-stream flow benefit in Sacramento River				4,5	RD 1004	Install new check structure and	70	\$2,500	None, gate is designed to	Gate was provided through
33) Decrease nonproductive ET						ITRC water gate			automatically provide constant water elevation	University Program, funded by Reclamation; RD 1004 paid \$2,500
37) In-stream flow benefit in Butte Creek										for gate abutments
30) In-stream flow benefit in Sacramento River				4,5	RD 1004	Install a pair of weirs	1,200	ł	Increased system control with new weirs	Unknown
37) In-stream flow benefit in Butte Creek									with new wens	
30) In-stream flow benefit in Sacramento River	2005	2005	2010	4	MFWC	Construct one groundwater extraction well	1,500	\$70,000	Well output will be monitored	Submitted for Prop 50, Chapter 8 funding for Integrated Regional
<b>34 and 35)</b> Provide long-term diversion flexibility to increase water supply for beneficial use of wetlands and other suitable lands						OARGONOT WOIL				Water Management
30) In-stream flow benefit in Sacramento River	2005	2005	2008	4	SMWC	Recycle irrigation	25,000	\$12,000 <sup>b</sup>	Lift pumps that recycle	Funding for feasibility study will be
<b>34 and 35)</b> Provide long-term diversion flexibility to increase water supply for beneficial use of wetlands and other suitable lands									drainage water will be monitored	pursued through future rounds of WUE grant funding
30) In-stream flow benefit in Sacramento River	2005	2005	2007	4	SMWC	Line canal	1,000	\$14,000 <sup>b</sup>	Action-specific monitoring	Submitted for Prop 50, Chapter 8
33) Decrease nonproductive ET									plan will be included in construction contract	funding for Integrated Regional Water Management
30) In-stream flow benefit in Sacramento River	2005	2005	2007	4	SMWC and RD 1500	Install six production wells for	5,000	\$200,000 <sup>b</sup>	Well output will be monitored	Submitted for Prop 50, Chapter 8
<b>34 and 35)</b> Provide long-term diversion flexibility to increase water supply for beneficial use of wetlands and other suitable lands						groundwater management program				funding for Integrated Regional Water Management
30) In-stream flow benefit in Sacramento River	2005	2005	2006	4	PMWC	Install one production well for	1,000	\$57,000	Well output will be monitored	Submitted for Prop 50, Chapter 8
<b>34 and 35)</b> Provide long-term diversion flexibility to increase water supply for beneficial use of wetlands and other suitable lands						groundwater management program				funding for Integrated Regional Water Management

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TABLE 4-1
Summary of Applicable Targeted Benefits and Proposed Actions
2009 Sacramento Valley Regional Water Management Plan Annual Update

Targeted Benefit	Analyze	Priority	Implement	CALFED Sub- region	Participating SRSCs	Proposed Action	Maximum Contribution to QO from Proposed Action (ac-ft)	Locally Beneficial Portion of Action <sup>a</sup>	Action-specific Monitoring Plan	Funding Sources
30) In-stream flow benefit in Sacramento River				4	PMWC	Line canal	300	\$80,000	None	Fiscal Year 2007 Challenge Grant
33) Decrease nonproductive ET										Program provided \$80,000; PMWC provided the remaining \$80,000
57) In-stream flow benefit in Sacramento River	2005	2005	2007	7	NCMWC	Construct 13 groundwater	15,000	\$200,000 <sup>b</sup>	Well output will be monitored	Submitted for Prop 50, Chapter 8
63) Decrease nonproductive ET						extraction wells				funding for Integrated Regional Water Management
<b>64 and 65)</b> Provide long-term diversion flexibility										
57) In-stream flow benefit in Sacramento River				7	NCMWC	Install new pump station and fish	1,400	TBD	River diversion will be	CALFED and Reclamation
63) Decrease nonproductive ET						screen on Sacramento River			monitored	awarded \$1.5 million for design and permitting
<b>64 and 65)</b> Provide long-term diversion flexibility										
57) In-stream flow benefit in Sacramento River				7	NCMWC	Improve flow monitoring in Natomas Basin	4,500	\$187,000	Flows within NCMWC and between districts will be	Prop 50 WUE grant awarded \$163,000; NCMWC paid the
63) Decrease nonproductive ET						Natorias Dasiri			monitored	remaining \$187,000
<b>64 and 65)</b> Provide long-term diversion flexibility										

<sup>a</sup>Cost-benefit analysis will be performed if funding is not received to determine what portion of project, if any, is economically feasible for a local agency to undertake. The presentation of these local and external benefits and the associated costs will be included in the annual updates at the time the QOs are analyzed.

<sup>b</sup>Local funding amount varies depending on type and application of project. Historical average of local contribution varies from 5 to 20 percent of project cost provided through in-kind services by the Company/District. Five percent of estimated project cost was used for projects yet to apply for funding. The local contribution for these projects will be updated as funding is sought and acquired.

<sup>c</sup>Project is 100 percent District funded. Exact amount will be determined at project completion.

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#### **SECTION 5.0**

# Identification of Actions to Implement and Achieve Proposed Quantifiable Objectives

Section 5.0 revisions to the RWMP are highlighted below in shaded text. An update of all previously identified projects was completed, and any new projects identified by the SRSCs since the completion of the initial RWMP were added, including description, schedule, budget, and funding sources.

# 5.1 Redding Sub-basin

Table 5-1 lists and describes potential projects in the Redding Sub-basin.

TABLE 5-1
Potential Projects in the Redding Sub-region

2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Title	District	Sub-basin	Description	Potential QO (ac-ft)	Applicable TBs
ACID Churn Creek Lateral Improvements	ACID	Redding	Construct a pipeline to replace a leaky canal lateral in a section east of the Sacramento River	8,700	6, 7
ACID Main Canal Modernization Project	ACID	Redding	Construction to automate the system to reduce diversions spills	20,000	6, 8
ACID Conjunctive Use Program	ACID	Redding	Construct 4 groundwater extraction wells	6,800	6, 8
ACID and Olney Creek Watershed Restoration Project	ACID	Redding	Replace existing hydraulic structure with an inverted siphon	2,100	6
Cottonwood Creek Siphon Improvements Project	ACID	Redding	Replace portion of existing siphon with a new siphon	1	4

# 5.2 ACID Churn Creek Lateral Improvements Project

# 5.2.1 Project Description

ACID proposes to improve its Churn Creek lateral system to increase water delivery and on-farm use efficiencies. The project will have an estimated water savings of up to 8,700 ac-ft and enable landowners to more efficiently apply water. By improving the ACID delivery system, landowners could modify on-farm water application systems from flood irrigation to sprinkler irrigation. Sprinkler irrigation under existing delivery conditions is not viable, but landowners might potentially apply three to four times less water with sprinkler irrigation.

A new pipeline will be the key component to a new pressurized system to serve the Churn Creek Bottom area and replace the existing unlined open ditch. A pressurized system will allow landowners, if feasible to their operations, to modify irrigation practices to significantly reduce water consumption. ACID has been working with Reclamation to introduce a sprinkler pilot program in this area of the District. The new pipeline would extend from the pumping plant on the Sacramento River, eastward to the current junction box structure at Smith Road. This pipeline would replace three canal laterals and extend along the current alignment of these laterals. Additionally, a canal lateral that begins immediately east of Interstate 5 would be replaced with a pipeline. In total, 14 miles of pipeline would be installed, 1.4 miles to replace the existing Churn Creek lateral and 12.6 miles of appurtenant laterals.

This project would also upgrade the current pumping station, located on the Sacramento River, to provide adequate pressure and flow. Two options will be examined for this upgrade. The first option would be to upgrade the existing pumps to provide gravity flow to turnouts located on the lateral. This option includes installing pumps at each turnout to supply the desired pressure and flow for sprinkler systems. The other option is to replace or expand the existing pumps at the pump station to provide necessary pressure and flow to all the ACID turnouts.

Phase 2A is funded and expected to be completed by December 2009. This phase of the ACID Churn Creek Lateral Improvements Project will include the lining of approximately 0.5 mile of the upper portion of ACID's Churn Creek lateral in an area of high soil porosity. The canal prism, including the side slopes and invert, would be shaped, smoothed, and compacted. A layer of geotextile material would then be placed on top of the earthen canal prism. A rubber polymer geomembrane lining would be secured in the canal and provide the top layer of the canal lining. This portion of the overall project buildout is being funded by Reclamation. Additional phases will be conducted as funding is available.

Targeted Benefits for this project are listed in Table 4-1.

#### 5.2.2 Schedule

The project schedule shown in Table 5-2 will commence upon appropriation of funding. The proposed schedule assumes that funding requests and appropriations occur within one phase. This project would likely be completed in several phases. Depending on the actual availability of funding, the implementation timeframe for completion of tasks could extend beyond the schedule shown in Table 5-2.

# TABLE 5-2 ACID Churn Creek Lateral Improvements Project Schedule 2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks	Project Status – Ongoing and Completed Work
Feasibility	Phase 1 (feasibility study) was completed in 2003; given project conditions and assumptions have changed to some degree, an update of the current feasibility study would be required before commencing design
Pilot Program	Ongoing for 2005 irrigation season; cooperative program between Reclamation and ACID

TABLE 5-2
ACID Churn Creek Lateral Improvements Project Schedule
2009 Sacramento Valley Regional Water Management Plan Annual Update

<b>Project Tasks</b>		Project Status – Ongoing and Completed Work										
Environmental Document		ogrammatic document is in progress and will be completed by spring 2006; supplemental ocumentation and permitting is expected to be required during design										
Phase 2A	To be st	be started third quarter 2009 and completed fourth quarter 2009										
	Project	roject Duration – Work to be Completed (Buildout)										
		Year 1 Year 2 Year 3										
Quarter	1	2	3	4	1	2	3	4	1	2	3	4
Final Design							•					
Permitting												
Construction												

### 5.2.3 Cost and Funding Sources

The estimated cost for the ACID Churn Creek Lateral Improvements Project feasibility study was \$144,000. ACID received funding for the study through the Department's Agricultural Water Use Efficiency Program funded through State Proposition 50. As a result, preliminary findings for lateral improvements were developed. In addition, ACID has worked with Reclamation to fund phased improvements along the upper end of the Churn Creek lateral (see description of Phase 2A). Reclamation has awarded \$30,000 funding to ACID, combined with local cost share, to improve 300 feet of the lateral.

ACID continues to work with the Department to find ways to partner on projects that will result in improved management and efficiencies within the Churn Creek lateral system. Prior to the budget crisis and subsequent freeze on California bond funding, the Department had been responding favorably to the idea of continued funding for this project.

# 5.3 ACID Main Canal Modernization Project

# 5.3.1 Project Description

In 2000, ACID recognized a need to improve its delivery system. In 2002, ACID completed a feasibility study in partnership with the Department that identified high-priority improvements for its Main Canal system. ACID is following through with its commitment to improving the efficiency of its system and is continuing to work in conjunction with the state to implement these system improvements in a phased approach. To conserve water and more efficiently use its surface water resource, ACID has identified the following five primary improvements:

 Lining of five high-seepage canal segments (approximately 2 miles of the 35-mile earthen Main Canal)

- Installation of five new automated check structures to provide much-needed (and currently lacking) water surface elevation control
- Installation of 12 new, automated turnouts with measurement flumes
- Replacement of two creek crossings to hydraulically separate the Main Canal from Olney Creek and Crowley Gulch
- Repair of two inverted siphon creek crossings at Clear Creek and Cottonwood Creek

These improvements, resulting in significantly better operational control, could also result in a combined estimated annual water savings of up to approximately 20,000 ac-ft when completed.

Targeted Benefits for this project are listed in Table 4-1.

#### 5.3.2 Schedule

ACID is in the process of designing and constructing the first phase of this project. The buildout phases will commence upon appropriation of additional funding. The project schedule is shown in Table 5-3.

TABLE 5-3
ACID Main Canal Modernization Project Schedule
2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks			Proje	ect Sta	tus – C	Ongoi	ng and	d Comp	leted	Work		
Feasibility Study	Comp	oleted										
Environmental Document, Phase 1		Environmental document is in process and scheduled to be completed by May 1, 2009										
Permitting, Phase 1		Permitting is in process with state and federal agencies; permits are expected to be in place by June 2009										
Final Design, Phase 1	Final	desigi	n is in <sub>l</sub>	proces	s and s	chedu	led to	be com	pleted	by Jun	ie 30, i	2009
Construction, Phase 1	Cons 2010	tructio	n is ex	pected	I to beg	in in A	August	2009 a	nd be	comple	ted by	May
I		Proj	ect Du	ıration	– Wor	k to b	e Con	npleted	(Futu	re Pha	ses)	
		Ye	ar 1			Y	ear 2			Yea	ar 3	
I	1	2	3	4	1	2	3	4	1	2	3	4
Final Design, Buildout												
Environmental Documentation and Permitting, Buildout	I	I										
Construction, Buildout						I	1	1	1	1		

# 5.3.3 Cost and Funding Sources

The estimated construction cost for the ACID Main Canal Modernization Project was \$10.8 million in 2002. This order-of-magnitude cost was determined as part of a feasibility

study (Phase 1A, April 2002). Using a standard assumption of 4 percent escalation, this project is now estimated to cost approximately \$12.3 million. The cost estimate will be refined during final design. ACID is seeking grant monies through the state to implement future phases of this project. Phase 1 of the project has been funded jointly by ACID and the Department through the Agricultural Water Use Efficiency Program for a total of \$1,875,000. Phase 1 construction is expected to be completed by spring 2010. Project status will be presented in future updates to this RWMP.

# 5.4 ACID Conjunctive Water Management Program

### 5.4.1 Project Description

ACID is advancing a conjunctive water management program that would responsibly and efficiently develop a vastly underused, groundwater basin that is subject to extensive natural recharge. As an active participant on the Redding Area Water Council and in the SVWMP, ACID recognizes the need to conjunctively manage surface water and groundwater resources to meet projected regional demands and satisfy the Phase 8 Settlement Agreement.

The project would supply water to meet peak demands during drought years, and it could provide additional benefits during normal and wet years. Any solution to water supply and reliability needs here, in the area of origin, would potentially result in water supply, water quality, and environmental benefits to the Redding Sub-basin and the Bay-Delta region.

ACID has a Sacramento River diversion and an extensive conveyance system throughout the west side of the Redding Sub-basin, which overlies a highly productive aquifer. This combination of attributes offers ACID a unique opportunity to provide regional solutions to the sub-basin, which does not meet projected water supply demands in dry years, especially during CVP cut-back years. The ACID Conjunctive Water Management Program would accomplish the following goals and objectives:

- Establish a groundwater monitoring network (This effort is underway. ACID works
  with the Department to monitor 13 existing groundwater monitoring wells and
  continues to seek additional funding for expansion of the monitoring network.)
- Establish a groundwater production program that, in Phase 1, would provide up to 6,800 ac-ft/yr of supplemental water supply to offset surface water diversions from the Sacramento River
- Satisfy the water supply and reliability needs of agricultural water users in the ACID service area
- Help satisfy the water supply and reliability needs of in-basin water users in the Redding Basin Water Resources Management Plan
- Contribute to the Sacramento Valley Water Management Agreement

Targeted Benefits for this project are listed in Table 4-1.

### 5.4.2 Schedule

The project schedule shown in Table 5-4 will commence upon appropriation of funding.

#### TABLE 5-4

ACID Conjunctive Water Management Program Schedule

2009 Sacramento Valley Regional Water Management Plan Annual Update

<b>Project Tasks</b>			Proj	ect St	tatus -	Ongo	ing an	d Com	pletec	l Work		
Install Groundwater Monitoring Infrastructure	data f	for effe	ective	basin		manag	currentl					ine
Feasibility and Pre-design	Comp	oleted;	; poter	ntial w	ell loca	ations \	were id	entified	l in 200	00		
Groundwater Management Planning	Ongo	ing sir	nce the	e late	1990s							
Environmental Document	In pro	gress	; to be	com	oleted	by 201	0					
			P	rojec	t Durat	tion –	Work t	o be C	omple	ted		
		Yea	ar 1			Ye	ar 2			Ye	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Final Design												
Permitting												
Construction												
Implementation	•—					t least nstrate	10 yea				s no	

# 5.4.3 Cost and Funding Sources

The cost for the development of the ACID Conjunctive Water Management Program is estimated to be \$3.2 million. ACID sought public assistance to implement this program through the Sacramento Valley Integrated Regional Water Management Plan (SVIRWMP) and California State Proposition 50 Grants. The former provided funding of \$1.24 million plus 10 percent local cost share. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.4.4 ACID Olney Creek Watershed Restoration Project

### 5.4.4.1 Project Description

ACID proposes with its project partners to remove the Olney Creek structure, siphon the ACID Canal under the creek, and improve the Olney Creek banks.

At the intersection of the ACID Main Canal and Olney Creek, an approximate 80-year-old structure exists that was intended to convey ACID irrigation water above the creek bed during the irrigation season and flood flows from Olney Creek in the winter. Flow through the structure is directed by placing (or removing) flashboards on all four sides of the rectangular structure. The configuration of the structure and the use of the flashboards leave the structure subject to vandalism, resulting in unwanted spills and public safety issues.

From a hydraulic and hydrologic standpoint, the configuration is undesirable, resulting in inefficient deliveries and spills to the creek that can cause unnaturally high flows during dry summer months and, in some cases, false attraction and subsequent stranding of salmon in otherwise dry or warmwater streams.

Furthermore, the canal banks have deteriorated to the point that they no longer provide adequate protection to residential areas in low-lying downstream areas. In the winter of 2005-2006, more than 20 mobile homes in a mobile home park incurred several feet of flood damage (ranging from 6 inches to 5 feet) due to a low point in an approximate 150-foot reach between a 1,900-foot levee and the ACID Main Canal.

ACID is working in cooperation with local and regional partners, including USFWS, CDFG, and the McConnell Foundation to help restore and rehabilitate the Olney Creek floodway in the vicinity of the creek's intersection with the ACID Main Canal.

The objectives for the ACID Olney Creek Watershed Restoration Project are as follows:

- Provide flood damage reduction through bank restoration to provide 25-year flood protection to more than 20 homes of a disadvantaged community downstream of a deteriorated creek bank.
- Restore the natural creek bed by hydraulically separating the ACID Main Canal from Olney Creek (i.e., siphoning the canal under the creek).
- Lessen public safety concerns by removing a potentially dangerous structure that is
  often vandalized during the irrigation season and rainy season.
- Prevent the conveyance of flood flows to areas outside of the Olney Creek watershed by hydraulically separating the creek from the canal.
- Prevent unnatural fish attraction flows within the creek caused by unintended canal spills, yet allow controlled flows as desired by the resource agencies by installing a turnout from the canal to the creek.
- Prevent debris buildup that can negatively affect water quality.

The total water loss can be up to 2,010 ac-ft/yr. Targeted Benefits for this project are listed in Table 4-1.

#### 5.4.4.2 Schedule

The proposed schedule is shown in Table 5-4A.

#### TABLE 5-4A

**ACID Olney Creek Watershed Restoration Project** 

2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks	Project Status – Ongoing and Completed Work											
Administrative	See	Seeking funding to proceed to design in 2009										
I		Project Duration – Work to be Completed										
		Year 1 Year 2 Year 3										
I	1	2	3	4	1	2	3	4	1	2	3	4
Final Design	I	I										
Environmental Documentation	ı	L										
Construction			I	1								

#### 5.4.4.3 Cost and Funding Sources

This project has great appeal to several resource agencies because of the myriad of regional benefits. This project was seeking funding from the Department in a grant round (with positive feedback from the Department) through the watershed and parks and trails divisions. The application has been submitted, but the grant round has been delayed because of the California state budget crisis. ACID has several partners for this project including USFWS, CDFG, the McConnell Foundation, and the local landowners (looking to invest their time and money to improve the watershed). In 2008, the overall project was estimated to cost \$1.7 million.

# 5.4.5 Cottonwood Creek Siphon Improvements Project

#### 5.4.5.1 Project Description

The Cottonwood Creek Siphon is a 48-inch-diameter inverted siphon, built around 1920, that allows the ACID Main Canal to pass beneath Cottonwood Creek. The Cottonwood Creek Siphon Improvement Project would remove a portion of the existing siphon, roughly 150 feet long, and replace this portion with a new siphon of similar size.

This project would improve the physical habitat for all life stages of anadromous fish, improve the opportunity for adult fish to reach their spawning habitats in a timely manner, and protect and restore natural channel and riparian habitat values. Further streambed degradation could impede fish passage up and down Cottonwood Creek. This project would improve aquatic ecosystem conditions in Cottonwood Creek by removing a flow impediment.

Targeted Benefits for this project are listed in Table 4-1.

#### 5.4.5.2 Schedule

The project schedule for funding is shown in Table 5-4B.

TABLE 5-4B

Cottonwood Creek Siphon Improvements Project

2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks	Project Status – Ongoing and Completed Work											
Administrative	Seel	Seeking funding to proceed to design in 2009										
I		Project Duration – Work to be Completed										
		Year 1 Year 2 Year 3										
I	1	2	3	4	1	2	3	4	1	2	3	4
Engineering	I	I										
Permitting	1	1 1										
Mobilization/Monitoring	Т		I	1								

### 5.4.5.3 Cost and Funding Sources

This proposal was submitted in June 2008, for funding through the USFWS Anadromous Fish Restoration Program. The proposal was not awarded funding, but District management was informed that this project had been moved to near the top of the Program's priority list for fiscal year 2009, and will likely be funded in the next round of review. The total cost of the project is estimated to be \$130,000.

# 5.5 Colusa Sub-basin

Table 5-5 lists and describes potential projects in the Colusa Sub-basin.

TABLE 5-5

Potential Projects in the Colusa Sub-basin

2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Title	District	Sub-basin	Description	Potential QO (ac-ft)	Applicable TBs
GCID Main Canal Modernization Project (Flow Measurement Devices in Main Canal, Lateral System, and Drain Outflow Points/ GCID Existing Automation Program)	GCID	Colusa	Design and construction of 12 flow measurement devices at previously identified system outflow points; design and construction of five main canal check structures.	40,000	20, 26, 27, 29
GCID Conjunctive Water Management Program	GCID	Colusa	Development of a ground- water program consistent with GCID and regional objectives, inclusive of both groundwater monitoring and extraction. Extraction could result from pumping of privately owned or District wells.	27,300	20, 26, 27, 29

TABLE 5-5
Potential Projects in the Colusa Sub-basin
2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Title	District	Sub-basin	Description	Potential QO (ac-ft)	Applicable TBs
GCID Colusa Basin Drain Regulating Reservoir	GCID	Colusa	Construct a 30,000 to 40,000 ac-ft regulating reservoir on the Colusa Basin Drain.	50,000	20, 21, 22, 23, 26, 27, 29
GCID Drain Water Outflow Measurement Program	GCID	Colusa	Construct flow measurement sites with telemetry dedicated to the measurement of GCID system outflows.	20,000	20, 26, 27, 29
RD 108 Conjunctive Water Management Program	RD 108	Colusa	Installation of up to five production wells for groundwater management program.	8,000	20, 26, 27, 29
RD 108 Flow Control and Measurement Project	RD 108	Colusa	Replace 5 Flashboard Checks with combination ITRC flap gate and ramp flume.	2,000	20, 26, 27, 29
RD 108 Northern Area Groundwater Study	RD 108	Colusa	Characterize the groundwater system underlying the northern portion of the District.	+	26, 27, 29
RD 108 Recycled Water Improvement Project	RD 108	Colusa	Increase capacity of existing recycled water pump stations.	15,000	20, 24, 26, 27, 29
RD 108 Recycled Water Management Project	RD 108	Colusa	Improve the operations and management of three existing recycled water pump stations.	4,000	20, 24, 26, 27, 29
PCGID Conjunctive Water Management Program	PCGID	Colusa	Development of a conjunctive water management program.	5,000	20, 26, 27, 29
PID Conjunctive Water Management Program	PID	Colusa	Development of a conjunctive water management program.	5,000	20, 26, 27, 29

# 5.6 GCID Main Canal Modernization Project

# 5.6.1 Project Description

This project is expected to conserve a maximum of 40,000 ac-ft of water annually.

GCID proposes to automate its main canal structures to increase water use efficiency. Operational spills would be reduced by replacing four check structures and constructing a Tainter gate downstream of the Stony Creek Siphon.

Further improvements include upgrading GCID's spread spectrum ethernet device, developing software for canal gate operation, standardizing software, installing sensors, providing mobile SCADA units, upgrading the central office hardware, and entering into an agreement with the neighboring Tehama-Colusa Canal Authority (TCCA) for operation of Funks Reservoir and intertie.

When possible, construction would occur outside of the irrigation season. The main canal conveys water year-round; however, many of the laterals do not require year-round deliveries. Canal bypasses would maintain main canal flows and deliveries during construction.

Targeted Benefits for this project are listed in Table 4-1.

#### 5.6.2 Schedule

The project schedule shown in Table 5-6 will commence upon appropriation of funding. The construction of this project will be executed in phases and is not expected to be completed in its entirety within the duration of this RWMP.

TABLE 5-6
GCID Main Canal Modernization Project Schedule
2009 Sacramento Valley Regional Water Management Plan Annual Update

<b>Project Tasks</b>			Proje	ect Sta	atus –	Ongoi	ing an	d Com	pletec	l Work		
Feasibility and Pre-design	Comp	oleted	as par	t of th	e wildl	ife refu	ge wat	er sup	ply			
Environmental Document		Programmatic document is completed; supplemental documentation and permitting is expected to be required during design										
Implementation	Imple	Implementation is in progress and expected to be completed in winter 2010										
	Project Duration – Work to be Completed											
		Yea	ar 1			Yea	ar 2			Yea	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Final Design												
Supplemental Environmental Documentation and Permitting												
Implementation												

# 5.6.3 Cost and Funding Sources

The estimated construction cost for all phases of the GCID Main Canal Modernization Project was \$8.7 million in 2001. Using a standard assumption of 4 percent escalation, this project is now estimated to cost approximately \$11.9 million. GCID received \$2.7 million for automation and SCADA upgrades through California State Proposition 50 Grants. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.7 GCID Conjunctive Water Management Program

# 5.7.1 Project Description

GCID is moving forward with the expansion and development of an existing conjunctive water management program. GCID has evaluated the need for conjunctive management of its groundwater and surface water resource annually the last 2 decades. In years of constrained surface water supply (due to infrastructure failures or drought years), GCID has worked with its landowners to develop annual voluntary groundwater programs (e.g., the 2001 Forbearance Program). GCID is formalizing its groundwater programs into a conjunctive water management program that would provide for the coordinated operation of a network of existing and planned groundwater wells within the GCID service area. The

system would be composed of private groundwater wells, one existing GCID well, and up to 10 planned GCID wells. The total production of the program is expected to be approximately 30,000 ac-ft of water per year. Implementation of the program would be flexible as prescribed in an operating plan (to be developed), allowing the water to be produced in various scenarios ranging between the following: (1) private wells might provide a maximum of 15,000 ac-ft, and up to eight GCID wells (one existing and seven proposed wells) would provide a maximum of 15,000 ac-ft; and (2) up to eleven GCID wells (one existing and ten proposed wells) would provide up to 30,000 ac-ft of groundwater. GCID has agreements with approximately 100 private landowners (approximately 110 participating wells) as part of past voluntary conjunctive water management programs. These private wells may participate in the program in any given year in accordance with negotiated agreements and the operating plan. The program would operate annually as required by in-basin or out-of-basin users.

Targeted Benefits for this project are listed in Table 4-1.

#### 5.7.2 Schedule

The project schedule shown in Table 5-7 will commence upon appropriation of funding.

TABLE 5-7
GCID Conjunctive Water Management Program Schedule
2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks		Pr	ojec	t Sta	atus -	Ongo	oing a	and (	Comp	lete	d Wor	k
Install Groundwater Monitoring Infrastructure		_				990s and C				nty a	nd mo	ore
Installation of Groundwater Production Infrastructure		_	ess; t pro			wells	will b	oe ins	stalled	d in 2	005 a	s part
Groundwater Management Planning	Ong	goin	g sin	ce la	te 199	90s						
Environmental Document	In progress; to be completed by spring 2006											
			Pro	ject	Durat	ion –	Worl	k to k	oe Co	mple	eted	
		Ye	ar 1			Yea	ır 2		Year 3			
	1	2	3	4	1	2	3	4	1	2	3	4
Final Design												
Permitting												
Construction												
Implementation	For at least 10 years, assuming there is no demonstrated impact to sustainability											

# 5.7.3 Cost and Funding Sources

The cost for the development of the GCID Conjunctive Water Management Program is estimated to be \$7.2 million. GCID is seeking public assistance to implement this program through the SVWMP and California State Proposition 50 Grants. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.8 GCID Colusa Basin Drain Regulating Reservoir Project

## 5.8.1 Project Description

GCID proposes to help regulate peak flows in the Colusa Basin Drain and dampen large fluctuations in flow by constructing a 30,000- to 40,000-ac-ft regulating reservoir. The reservoir facilities will include a pump station on the Colusa Basin Drain, a Colusa Basin Drain bypass channel, an outlet control system, water quality and flow volume instrumentation, and a water quality laboratory. This project is currently in the feasibility stage and is not expected to be completed during the duration of this RWMP. The project will potentially provide the following benefits:

- Create up to 40,000 ac-ft of available water (TB 20)
- Volatilize chemicals and dilute drain water with GCID canal water from the Sacramento River (TBs 21, 22, 23, and 24)
- Regulate Colusa Basin Drain flows to increase water supply reliability (TBs 26, 27, 28, and 29)

Targeted Benefits for this project are listed in Table 4-1.

#### 5.8.2 Schedule

The project schedule shown in Table 5-8 will commence upon appropriation of funding.

TABLE 5-8

GCID Colusa Basin Drain Regulating Reservoir Project Schedule 2009 Sacramento Valley Regional Water Management Plan Annual Update

	Project Duration											
		Yea	ar 1			Yea	ar 2			Yea	ar 3	
Quarter	1	2	3	4	1	2	3	4	1	2	3	4
Feasibility Study												
Environmental Document				To be	deter	mined	during	feasib	ility stu	dy		
Design				To be	deter	mined	during	feasib	ility stu	dy		
Construction				To be	deter	mined	during	feasib	ility stu	dy		
Implementation	To be determined during feasibility study											

# 5.8.3 Cost and Funding Sources

The estimated cost for the feasibility study portion of this project is \$500,000. A conceptual-level study has been funded by the Department Agricultural Water Use Efficiency Program for \$257,000 and GCID for \$50,000. An order-of-magnitude cost estimate for design and construction is \$250 million. The cost estimate will be refined during the final design. The development and implementation of this program will be documented in future updates to this plan. GCID is seeking funds to conduct the study from state and federal sources in addition to working with the Sacramento Valley Water Management Program. Should the regulating reservoir be deemed an economically and technically viable project by project partners, additional funding will be pursued.

#### **GCID Drain Water Outflow Measurement Program** 5.8.4

#### **Project Description** 5.8.4.1

GCID proposes constructing 12 flow measurement sites with telemetry that would be dedicated to the measurement of GCID system outflows. This project would improve water management within GCID and, conceivably, throughout the sub-basin.

Only daily measurements are retrieved at the 12 locations where approximately 80 percent of drain water leaves the District. Upgrading to continuous measurements will allow users to determine diurnal flow fluctuations to save an estimated 50 percent of the current main canal and lateral spills. This would result in an estimated savings of 20,000 ac-ft annually.

#### 5.8.4.2 Schedule

The project schedule shown in Table 5-8A will commence upon receipt of funding.

TABLE 5-8A
GCID Drain Water Outflow Measurement Program
2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks		Project Status – Ongoing and Completed Work												
Planning/Engineering	Seel	Seeking funding to proceed with program in 2009												
		Project Duration – Work to be Completed												
		Year 1 Year 2 Year 3												
	1	1 2 3 4 1 2 3 4 1 2 3 4												
Planning/Engineering														
Permitting														
Construction														

#### 5.8.4.3 **Cost and Funding Sources**

GCID sought funding through a Reclamation Water Conservation Grant in June 2007. The total project cost is estimated at \$200,000 and would be split evenly between Reclamation and GCID.

#### 5.9 RD 108 Conjunctive Water Management Program

#### **Project Description** 5.9.1

The RD 108 proposes to develop a conjunctive water management program that will provide the flexibility to pump and convey groundwater in lieu of some of its surface water supply. Initially, RD 108 will develop a groundwater project with a project capacity of up to 8,000 ac-ft per year. Five groundwater production wells would be located within the service area near RD 108's existing canals. Additionally, existing groundwater monitoring wells would be retrofit with dataloggers. The production wells would likely have capacities that range from 2,000 to 3,500 gpm. This project would help RD 108 meet the following objectives:

- Increase RD 108 water supply reliability and flexibility
- Increase in-stream flows during dry years

- Increase in-basin water supply reliability and flexibility
- Help satisfy the requirements of the Phase 8 Settlement Agreement

Targeted Benefits for this project are listed in Table 4-1.

#### 5.9.2 Schedule

The project schedule shown in Table 5-9 will commence upon appropriation of funding.

RD 108 Conjunctive Water Management Program Schedule 2009 Sacramento Valley Regional Water Management Plan Annual Update **Project Tasks** Project Status - Ongoing and Completed Work Install Groundwater Monitoring In progress; 12 monitoring wells are currently installed by the Department, numerous multi-completion monitoring wells in Colusa and Yolo County Infrastructure Pre-design Groundwater Management Completed in 2006; update adopted November 2008 **Environmental Document** In progress; to be completed by 2010 Project Duration - Work to be Completed Year 1 Year 2 Year 3 2 Final Design Permitting Construction Implementation For at least 10 years assuming there is no demonstrated impact to sustainability

# 5.9.3 Cost and Funding Sources

The cost for the development of the RD 108 Conjunctive Water Management Program is estimated to be \$3.7 million. RD 108 is seeking public assistance to implement this program through the SVWMP and California State Proposition 50 Grants. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.10 RD 108 Flow Control and Measurement Project

# 5.10.1 Project Description

RD 108 is replacing flashboard checks with 23 long-crested weirs, one ITRC flap gate, and three Rubicon flume gates. Five acoustic velocity flowmeters will be installed at strategic locations in the distribution canals, and approximately 80 farm turnouts will be calibrated for improved flow measurement. The project will improve water-level control and measurement, and provide simplified canal operation, resulting in approximately 2,000 ac-ft of water savings and \$20,000 in pumping cost savings annually.

Targeted Benefits for this project are listed in Table 4-1.

#### 5.10.2 Schedule

The project is 75 percent complete and scheduled for completion by December 2009.

TABLE 5-10

RD 108 Flow Control and Measurement Project Schedule 2009 Sacramento Valley Regional Water Management Plan Annual Update

**Project Tasks** Project Duration - Ongoing and Completed Work Year 1 Year 2 Year 3 1 2 3 2 3 1 2 3 Final Design - complete Permitting - complete Construction - to be completed by 12/09 Implementation For at least 20 years, the minimum expected life of the facilities

### 5.10.3 Cost and Funding Sources

The total project cost for the RD 108 Flow Control and Measurement Project is estimated to be \$600,000. A Reclamation Water Use Efficiency Grant will provide half of the cost.

# 5.10.4 RD 108 Northern Area Groundwater Study

### 5.10.4.1 Project Description

This study will help characterize the groundwater system underlying the northern portion of the District and will include the following components:

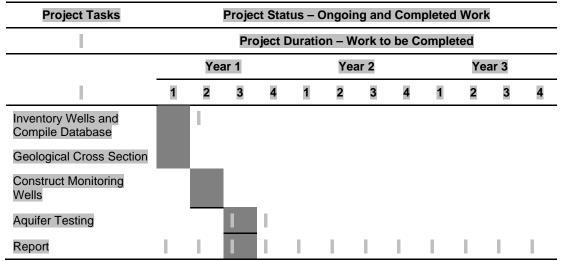
- Inventorying wells within the area and compiling a database of this information
- Reviewing gas well geophysical logs and preparing a geologic cross section through the northern portion of the District
- Constructing a multiple-completion monitoring well near an existing production well
- Conducting aquifer testing, evaluating the data collected throughout the project
- Documenting all work and conclusions in a summary report

The information and understanding developed from this project will provide a technical basis for evaluating potential groundwater management actions and potential future projects in and around the northern portion of the District. Such projects could lead to increased flexibility in the source and timing of diversions.

#### 5.10.4.2 Schedule

The project schedule is shown in Table 5-10A.

TABLE 5-10A Northern Area Groundwater Study 2009 Sacramento Valley Regional Water Management Plan Annual Update



### 5.10.4.3 Cost and Funding Sources

Funding for this project was initially applied for under the AB 303 program; however, it was not accepted, and funding was approved under a Proposition 84 Grant. The total project cost is \$276,000 with a District cost share of \$31,000.

# 5.10.5 RD 108 Recycled Water Improvement Project

#### 5.10.5.1 Project Description

This project will increase the capacity of existing recycled water pump stations, resulting in conservation of both pumping energy and water diverted from the Sacramento River and a reduction of lower quality water pumped back to the river. Pumps and motors from three recently abandoned pump stations in the Sacramento River will be moved to the recycled water pump stations. Other improvements will include variable-frequency drives on certain recycled water pumps, flow measurement on pump discharges, and automation of turnouts delivering recycled water. It is estimated that this project will conserve 15,000 ac-ft/yr, reduce salinity of river return water by 15 percent, and reduce pumping costs by \$80,000 per year.

#### 5.10.5.2 Schedule

The project schedule is shown in Table 5-10B.

TABLE 5-10B
Recycled Water Improvement Project

2009 Sacramento Valley Regional Water Management Plan Annual Update

<b>Project Tasks</b>		Project Status – Ongoing and Completed Work										
<b>Engineering Design</b>			ln p	orogre	ss; to	be co	mplet	ed by	June 2	2009		
1		Project Duration – Work to be Completed										
		Year 1 Year 2 Year 3										
I	1	2	3	4	1	2	3	4	1	2	3	4
Design		I										
Permitting			I									
Construction					I	I	1	1	ı	1		

#### 5.10.5.3 Cost and Funding Sources

The total project cost for the RD 108 Recycled Water Improvement Project is estimated to be \$1,000,000. A Proposition 50 Grant will provide half of the cost.

## 5.10.6 RD 108 Recycled Water Management Project

### 5.10.6.1 Project Description

This project will improve the operations and management of three existing recycled water pump stations, resulting in conservation of both pumping energy and water diverted from the Sacramento River, and a reduction of lower quality water pumped back to the river. The improvements will enhance system performance by providing coordination and integration of recycled water pump stations with river diversions; remote monitoring and control of pump operations, water levels, and salinity levels; and will prevent unscheduled pump shutdowns or pump damage from low water levels. Stilling wells will be installed in the drains and canals for monitoring water levels, and salinity meters will be installed to help manage water quality. It is estimated that this project will conserve 4,000 ac-ft/yr, reduce salinity of river return water by 4 percent, reduce pumping costs by \$22,000 per year, and reduce operations cost by \$5,000 per year.

#### 5.10.6.2 Schedule

The project schedule is shown in Table 5-10C.

#### TABLE 5-10C

Recycled Water Management Project

2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks		Project Status – Ongoing and Completed Work											
<b>Grant Application</b>	Con	Completed February 2008											
Construction	In p	In progress; to be completed winter 2008/2009											
I		Project Duration – Work to be Completed											
		Ye	ear 1			Ye	ar 2			Ye	ar 3		
1	1	1 2 3 4 1 2 3 4 1 2 3 4											
Construction													

#### 5.10.6.3 Cost and Funding Sources

The total project cost for the RD 108 Recycled Water Management Project is estimated to be \$50,000. A Reclamation Water Conservation Field Services Grant will provide half of the cost.

# 5.11 PCGID Conjunctive Water Management Program

### 5.11.1 Project Description

The PCGID proposes to develop a conjunctive water management program that will provide up to 5,000 ac-ft of groundwater supply that could be used in lieu of a similar quantity of diverted surface water. PCGID proposes using three existing, district-owned groundwater production wells or possibly installing two new district wells. Program goals include the following:

- Increase system reliability for in-basin users
- Increase system flexibility for in-basin users
- Contribute to satisfying the requirements of the Phase 8 Settlement Agreement

New wells would only be installed if the five existing wells that the PCGID has identified are determined insufficient to meet the needs of the program (e.g., production is low or there are air quality issues). PCGID has begun replacing the diesel motors on their groundwater wells with new electric motors to eliminate potential future air quality issues. PCGID, as a participant in the Sacramento Valley Water Management Program, Glenn County groundwater management, and Colusa County groundwater management, is seeking to establish appropriate levels of groundwater monitoring for successful and responsible management of the groundwater resource.

Targeted Benefits for this project are listed in Table 4-1.

#### 5.11.2 Schedule

The project schedule shown in Table 5-11 will commence upon appropriation of funding.

TABLE 5-11
PCGID Conjunctive Water Management Program Schedule
2009 Sacramento Valley Regional Water Management Plan Annual Update

Desired Tester			D	:( 0		0		.1 0		I \A/ =I.		
Project Tasks			Pro	ject St	atus -	- Ongo	ing an	d Com	pietec	ı work		
Install Groundwater Monitoring Infrastructure		gress; a Cou		omplisl	hed in	conjun	ction w	ith SV	WMP,	Glenn	County	/, and
Pre-design	In pro	gress;	to be	e com	oleted	in 2010	)					
Groundwater Management Planning	Ongo	ing sin	ce th	e late	1990s							
<b>Environmental Document</b>	Not n	eeded	until	wells	have b	een ap	proved					
			F	rojec	t Dura	tion – \	Nork to	o be C	omple	ted		
		Yea	ır 1			Ye	ar 2			Yea	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Final Design												
Permitting												
9												
Construction												

### 5.11.3 Cost and Funding Sources

PCGID will fund the program with district monies. If PCGID decides to install new groundwater production wells instead of using existing wells, they will not seek public funding. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.12 PID Conjunctive Water Management Program

# 5.12.1 Project Description

The PID proposes to develop a conjunctive water management program that will provide up to 5,000 ac-ft of groundwater supply that could be used in lieu of a similar quantity of diverted surface water. PID proposes using three existing, district-owned groundwater production wells or possibly installing two new district wells to help achieve the goals of the program, which include the following:

- Increase system reliability for in-basin users
- Increase system flexibility for in-basin users
- Contribute to satisfying the requirements of the Phase 8 Settlement Agreement

New wells would only be installed if the four existing wells that PID has identified are determined to not meet the needs of the program (e.g., production is low or there are air quality issues). PID has initiated work to convert existing diesel motors to electric motors to eliminate future air quality issues that might arise. PID, as a participant in the Sacramento Valley Water Management Program, Glenn County groundwater management, and Colusa County groundwater management, is seeking to establish appropriate levels of groundwater monitoring for successful and responsible management of the groundwater resource.

#### Targeted Benefits for this project are listed in Table 4-1.

### 5.12.2 Schedule

The project schedule shown in Table 5-12 will commence upon appropriation of funding.

TABLE 5-12
PID Conjunctive Water Management Program Schedule
2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks			Proje	ect St	atus –	Ongo	ing an	d Com	pleted	l Work		
Install Groundwater Monitoring Infrastructure		gress; a Cou		mplisł	ned in (	conjund	ction w	ith SV\	WMP,	Glenn	County	, and
Pre-design	In pro	gress	to be	comp	oleted i	n 2010						
Groundwater Management Planning	Ongo	ing sir	ice lat	e 199	0s							
<b>Environmental Document</b>	Not n	eeded	until v	vells l	nave b	een ap	proved					
			P	roject	Durat	ion – \	Nork t	o be C	omple	eted		
		Yea	ar 1			Yea	ar 2			Yea	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Final Design												
Permitting												
Construction												
Implementation	•			<b></b>		: least 1 nstrate					s no	

# 5.12.3 Cost and Funding Sources

The PID will fund the program with district monies. If PID decides to install new ground-water production wells instead of using existing wells, they will not seek public funding. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.13 Butte Sub-basin

Table 5-13 lists and describes potential projects in the Butte Sub-basin.

TABLE 5-13
Potential Projects in the Butte Sub-basin
2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Title	District	Sub-basin	Description	Potential QO (ac-ft)	Applicable TBs
RD 1004 Canal Lining Project	RD 1004	Butte	Extend canal lining on approximately 1.5 miles of the main canal; the first 0.5 mile of main canal is a lined channel which dumps into an unlined slough	3,500	30, 33, 37, 46
RD 1004 Conjunctive Water Management Program	RD 1004	Butte	Installation of two extraction wells	5,000	30, 33, 34, 35, 37, 43, 47, 48
RD 1004 White Mallard Dam and Fish Ladder Replacement Project	RD 1004	Butte	Removed and replaced White Mallard Dam on Butte Creek and install weir and fish screen near Five-Points	17,000	30, 34, 35, 43
RD 1004 Flowmeter Replacement Program	RD 1004	Butte	Upgrade analog turnout meters with digital meters	1,600	30, 33, 34, 35, 37, 47 48
RD 1004 Recirculation Pump 8 Rebuild Project	RD 1004	Butte	Redesigning and rebuilding Recirculation Pump 8	3,800	30, 34, 35, 37
RD 1004 ITRC Water Gate Project	RD 1004	Butte	Install one self-adjusting check structure	70	30, 33, 37
RD 1004 10-Foot by 8-Foot Weirs Installation Project	RD 1004	Butte	Installed two 10-foot by 8-foot weirs at the downstream end of RD 1004's main canal	1,200	30, 37

# 5.14 RD 1004 Canal Lining Project

# 5.14.1 Project Description

This project is expected to conserve an estimated 10 to 15 percent of RD 1004's diverted surface water (approximately 5,600 to 8,400 ac-ft/yr). The project would promote water conservation by extending the lined portion of the RD 1004 Main Canal by approximately 1.5 miles. This project is the next phase of a traditional water use efficiency program started by RD 1004 in the late 1990s, when they lined approximately 0.5 mile of the uppermost portion of the Main Canal.

The RD 1004 Main Canal is subject to considerable conveyance losses through seepage, resulting in delivery inefficiencies. RD 1004 estimates that it currently loses as much as 60 cfs (the equivalent production of one pump) through the upper reaches of its Main Canal.

Targeted Benefits associated with this project are listed in Table 4-1.

#### 5.14.2 Schedule

The project schedule shown in Table 5-14 will commence upon appropriation of funding.

TABLE 5-14
RD 1004 Canal Lining Project Schedule
2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks			Pr	oject S	Status -	- Ongo	ing an	d Com	pleted	Work		
Phase 1 – New Diversion and Canal Lining	Compl	leted										
Environmental Document		nment	al imp	act rep	; supple ort or e							the required
				Proje	ct Dura	tion – '	Work t	o be C	omplet	ed		
		Ye	ar 1			Yea	ar 2			Y	ear 3	
Quarter	1	2	3	4	1	2	3	4	1	2	3	Q4
Final Design												
Permitting and Environmental												
Construction												
Potential Mitigation	•		<b>—</b>		_	ion mo		itive ha g might				entified,

### 5.14.3 Cost and Funding Sources

The cost for the development of the RD 1004 Canal Lining Project is estimated to be \$3 million. The cost estimate will be refined during the final design. RD 1004 is seeking public assistance to implement this program through the SVWMP and California State Proposition 50 Grants. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.15 RD 1004 Conjunctive Water Management Program

# 5.15.1 Project Description

RD 1004 proposes to develop a conjunctive water management program that will provide up to 5,000 ac-ft of groundwater supply that could be used in lieu of a similar quantity of diverted surface water. The RD 1004 would install two groundwater production wells, with capacities estimated between 2,500 and 4,500 gpm, to help achieve the goals of the program, which include the following:

- Increase system reliability for in-basin users
- Increase system flexibility for in-basin users
- Contribute to satisfying the requirements of the Phase 8 Settlement Agreement

RD 1004, as a participant in the Sacramento Valley Water Management Program, is seeking to establish appropriate levels of groundwater monitoring for successful and responsible management of the groundwater resource.

#### Four New Production wells

With assistance from Ducks Unlimited, RD 1004 seeks to drill four deep water production wells and two monitoring wells capable of supplementing District surface water.

#### Targeted Benefits associated with this project are listed in Table 4-1.

#### 5.15.2 Schedule

The project schedule shown in Table 5-15 will commence upon appropriation of funding.

ABLE 5-15

RD 1004 Conjunctive Water Management Program Schedule Sacramento Valley Regional Water Management Plan

Project Tasks		Project Status – Ongoing and Completed Work										
Identification of Appropriate Groundwater Monitoring Locations	In pro	gress	; acco	mplish	ned in	conjund	ction w	ith the	SVWN	⁄IP		
Pre-design	In pro	In progress; to be completed by late summer 2005										
Groundwater Management Planning	Ongo	ing; a	ccomp	olished	l in cor	njunctio	n with	the Di	strict a	nd the	counti	es
Four new production wells	Estim	Estimated to be installed in 2010										
Environmental Document	In pro	gress	; to be	comp	eleted	n 2010	)					
			Р	roject	Durat	ion – \	Nork t	o be C	omple	ted		
	Year 1				Year 2				Year 3			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4
Final Design			_									
Permitting					_							
Construction												
Implementation	•—			<b></b>		t least 1 nstrate					s no	

## 5.15.3 Cost and Funding Sources

The cost for the development of the RD 1004 Conjunctive Water Management Program is estimated to be \$1 million. RD 1004 is seeking public assistance to implement this program through the SVWMP and California State Proposition 50 grants. The development and implementation of this program will be documented in future updates to this RWMP.

Funding is underway for the four new production wells through Ducks Unlimited, who would pay the project capital costs, estimated at \$4 million. RD 1004 will maintain and operate the wells at their own expense.

# 5.15.4 RD 1004 White Mallard Dam and Fish Ladder Replacement Project and Five-Points Project

#### 5.15.4.1 Project Description

The first phase of this project removed and replaced White Mallard Diversion Dam on Butte Creek, a tributary to the Sacramento River. The new dam provides a steady flow down a fish ladder, improving fish passage while more efficiently diverting water to RD 1004. This project improves fish passage, provides greater diversion flexibility, and leaves an estimated 17,000 ac-ft of water in the Sacramento River each year.

The second phase, the Five-Points Project, will install a weir and fish screen, and be the final phase of a current plan to further enhance water delivery capabilities and protect fish and

fish passage through the Butte Creek corridor. SCADA telemetry including measurement instrumentation will also be installed. The new SCADA would tie upstream projects together and balance creek elevations to benefit fish and District needs.

Targeted Benefits for this project are shown in Table 4-1.

#### 5.15.4.2 Schedule

The project schedule is shown in Table 5-15A.

#### TABLE 5-15A RD 1004 White Mallard Dam and Fish Ladder Replacement Project 2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks			Proje	ct Sta	tus – (	Ongoir	ng and	l Com	pleted	l Work	(	
Dam and Ladder Engineering Design	Com	pleted	l in Fel	bruary	2004							
Dam and Ladder Environmental Document	Com	pleted	l in Fel	bruary	2004							
Dam and Ladder Construction	Com	pletec	l in Oc	tober 2	2007							
Weir and Fish Screen Engineering Design	In pr	ogress	s; to be	e comp	oleted :	spring	2010					
Weir and Fish Screen Environmental Document	In pr	ogress	s; to be	e comp	oleted :	spring	2010					
Weir and Fish Screen Construction	Sche	eduled	to beg	gin in s	pring 2	2010 a	nd be	compl	eted ir	sumr	ner 20	10
			Pr	oject [	Duratio	on – W	ork to	be C	omple	ted		
		Ye	ar 1			Yea	ar 2			Ye	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Dam and Ladder Design												
Dam and Ladder Permitting			١.	١.								
Dam and Ladder Construction	ı	I			1			I	I	ı	I	I
		Ye	ar 4			Yea	ar 5		Year 6			
	1	2	3	4	1	2	3	4	1	2	3	4
Weir and Fish Screen Design												
Weir and Fish Screen Permitting												
Weir and Fish Screen Construction									ı	<u> </u>	П	ı

#### 5.15.4.3 Cost and Funding Sources

The project is funded by Ducks Unlimited at a cost of \$5.4 million (\$1.4 million for the dam replacement and \$4 million for the Five-Points Project). The \$65,000 cost of a new SCADA system is included in the \$5.4 million estimate. RD-1004 purchased right-of-way and surveying services at a cost to the district of \$25,000.

### 5.15.5 RD 1004 Flowmeter Replacement Program

#### 5.15.5.1 Project Description

In 1992, RD 1004 installed propeller meters to measure flow on every turnout in their district. These meters started to break down as moving parts got split and worn. Annual maintenance became so expensive and time consuming that RD 1004 decided in 2001 to slowly replace the analog meters with digital ones. The new digital meters require significantly less maintenance and allow RD 1004 to keep up their practice of measuring and charging for water at the turnout level.

Updating the analog meters with the digital meters saves an estimated 1 to 2 percent of total diversions, estimated around 1,600 ac-ft per year.

Targeted Benefits for this program are listed in Table 4-1.

### 5.15.5.2 Schedule

The project schedule is shown in Table 5-15B.

#### TABLE 5-15B

RD 1004 Flowmeter Replacement Program

2009 Sacramento Valley Regional Water Management Plan Annual Update

<b>Project Tasks</b>			Proje	ct Sta	tus – (	Ongoii	ng and	d Com	pleted	Work		
Installation of Turnout Meters	Com	pleted	arour	nd 199	2							
Upgrade of Turnout Meters	In pr	ogress	s; to be	e comp	oleted	on an a	as-nee	ded ba	asis			
			Pr	oject I	Duratio	on – W	ork to	be C	omple	ted		
		Ye	ar 1			Ye	ar 2			Yea	ar 3	
	1	Ye	ar 1 3	4	1	Yea	ar 2 3	4	1	Yea	ar 3 3	4
Installation of Turnout Meters	1	Ye 2	-	4	1	Yea	ar 2 3	4	1	Yea 2	ar 3 3	4

#### 5.15.5.3 Cost and Funding Sources

Installing the original flowmeters around 1992 was paid for by the individual farmers at a cost of approximately \$900 to \$1,200 per turnout. RD 1004 has since paid for all maintenance, including the upgrades from analog to digital meters. Upgrading one meter costs roughly \$500. With 135 meters in service, the total cost of upgrading all meters is approximately \$67,500.

Operating the flowmeters requires significant maintenance costs, and even the digital low maintenance meters cost approximately \$50 every year to keep running.

# 5.15.6 RD 1004 Recirculation Pump 8 Rebuild Project

#### 5.15.6.1 Project Description

This project includes redesigning and rebuilding Recirculation Pump 8, enhancing pump and sump efficiencies and allowing for higher recycled water flows. The pump is located in

one of several key northern areas where drain water can be picked up and placed into a high-line delivery canal, reducing the need to pump additional water from the Sacramento River. The project also includes the installation of a new doplar flowmeter to accurately measure recycled water. Pump improvements result in an estimated water savings of 3,800 ac-ft.

Targeted Benefits for this project are shown in Table 4-1.

#### 5.15.6.2 Schedule

The project schedule is shown in Table 5-15C.

#### TABLE 5-15C

Recirculation Pump 8 Rebuild Project

2009 Sacramento Valley Regional Water Management Plan Annual Update

<b>Project Tasks</b>	Project Status – Ongoing and Completed Work												
Redesign and Rebuild Recirculation Pump 8	To b	To be completed by January 2009											
Install Doplar Meter	To b	e inst	alled ir	ı Febru	uary 20	009							
I	Project Duration – Work to be Completed												
		Ye	ear 1		Year 2					Year 3			
I	1	2	3	4	1	2	3	4	1	2	3	4	
Design		1											
Permitting													

### 5.15.6.3 Cost and Funding Sources

The cost of rebuilding the pump is \$60,000, and the cost of the doplar meter is \$3,200. RD 1004 will pay for the entirety of this \$63,200 project.

# 5.15.7 RD 1004 ITRC Water Gate Project

#### 5.15.7.1 Project Description

The has developed a fully mechanical check structure that automatically adjusts to water flow to maintain constant canal elevation upstream of itself. RD 1004 is participating in this program through Cal Poly and will install one gate in their system.

This gate will provide greater system control, thereby improving water management and saving an estimated 70 ac-ft of water.

Targeted Benefits for this project are shown in Table 4-1.

#### 5.15.7.2 Schedule

Design was completed by Cal Poly as part of the program. The gate was installed and operational during fall 2009.

#### 5.15.7.3 Cost and Funding Sources

The gate is provided through the ITRC program, which is funded by Reclamation. The installation cost, including the cost of the abutments that support the gate, is approximately \$3,300, paid for by the District.

### 5.15.8 RD 1004 10-Foot by 8-Foot Weirs Installation Project

#### 5.15.8.1 Project Description

This project installed two 10-foot by 8-foot weirs at the downstream end of RD 1004's main canal. The weir raises water levels on their downstream side serving two primary purposes. Firstly, the high water surface diverts water through a new 84-inch screwgate turnout structure, also installed as part of this project. Secondly, the weirs allow the canal to remain full during winter floods. When kept full, the weight of the water in the canal counteracts the uplift force caused by high groundwater tables. Pervious soils and high water tables have caused significant damage to the canal lining since it was built in 1998. This damage results in significant seepage estimated at 1,200 ac-ft/yr.

Targeted Benefits for this project are shown in Table 4-1.

#### 5.15.8.2 Schedule

Design for this project was completed by the weir manufacturer and RD 1004. The weir boxes took several weeks to fabricate and were installed in 4 days.

#### 5.15.8.3 Cost and Funding Sources

The project was funded through a Reclamation grant from 1997. Most of this grant was used to pay for a District pumping plant, and a portion of the remainder was used to pay for the weir installation project. The cost of the weir and screwgate was approximately \$30,000.

# 5.16 Sutter Sub-basin

Table 5-16 lists and describes potential projects in the Sutter Sub-basin.

## TABLE 5-16 Potential Projects in the Sutter Sub-basin

2009 Sacramento	valley Regional	water wanayement	i Pian Annuai Upuale

Project Title	District	Sub-basin	Description	Potential QO (ac-ft)	Applicable TBs
MFWC Conjunctive Water Management Program	MFWC	Sutter	Installation of one ground- water production well	1,500	30,34,35
SWWC Irrigation Recycling Project	SMWC and RD 1500	Sutter	Feasibility analysis of a tailwater recovery system	25,000	30,34,35
SMWC and RD 1500 Joint Sutter Basin Drainwater Reuse Project	SMWC and RD 1500	Sutter	Feasibility study identifying alternatives for expansion of the existing drainwater reuse system	5,000	30, 34, 35
SWWC Canal Lining	SMWC	Sutter	Canal lining to reduce diversions and eliminate spills	1,000	30,33

TABLE 5-16
Potential Projects in the Sutter Sub-basin
2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Title	District	Sub-basin	Description	Potential QO (ac-ft)	Applicable TBs
SMWC and RD 1500 Joint Sutter Basin Groundwater Management Program	SMWC and RD 1500	Sutter	Groundwater investigation; installation of 12 monitoring wells and 6 production wells	5,000	30,34,35
PMWC Conjunctive Water Management Program	PMWC	Sutter	Construction of one ground- water production well	1,000	30,34,35
PMWC Canal Lining Project	PMWC	Sutter	Lining 1 mile of East 18 Canal	300	30, 33

# 5.17 MFWC Conjunctive Water Management Program

### 5.17.1 Project Description

The MFWC proposes to develop a conjunctive water management program that will provide up to 1,500 ac-ft of groundwater supply that could be used in lieu of a similar quantity of diverted surface water. The MFWC would install one groundwater production well with an estimated capacity between 2,000 and 3,500 gpm to help achieve the goals of the program, which include the following:

- Increase system reliability for in-basin users
- Increase system flexibility for in-basin users
- Contribute to satisfying the requirements of the Phase 8 Settlement Agreement

The MFWC, as a participant in the Sacramento Valley Water Management Program and through Sutter County is seeking to establish appropriate levels of groundwater monitoring for successful and responsible management of the groundwater resource.

Targeted Benefits for this project are listed in Table 4-1.

#### **5.17.2** Schedule

The project schedule shown in Table 5-17 will commence upon appropriation of funding.

TABLE 5-17
MFWC Conjunctive Water Management Program Schedule
2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks			Proje	ect S	tatus -	Ongo	ing an	d Con	pletec	l Work		
Groundwater Management Planning	_	Ongoing; accomplished in conjunction with Sutter County and the Department										
Preliminary Design	In pro	In progress; to be completed by 2009										
Environmental Document	In pro	gress	; to be	com	pleted l	by 201	0					
		Project Duration – Work to be Completed										
		Ye	ar 1			Ye	ar 2			Yea	ar 3	
Quarter	1	2	3	4	1	2	3	4	1	2	3	4
Final Design			_									
Permitting			_									
Construction												
					_	. 1 4 .	40			here is		

### 5.17.3 Cost and Funding Sources

The cost for the development of the MFWC Conjunctive Water Management Program is estimated to be \$800,000. The MFWC is seeking public assistance to implement this project through the SVWMP and California State Proposition 50 grants. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.18 SMWC and RD 1500 Joint Sutter Basin Drainwater Reuse Project

# 5.18.1 Project Description

SMWC, in conjunction with Reclamation District No. 1500 (RD 1500) and Pelger Mutual Water Company, is conducting a feasibility study that is identifying alternatives for expansion of the existing drainwater reuse system and the costs associated with the increased recapture. An enhanced drainage recapture program would enhance and optimize the use of applied surface water for irrigation purposes and minimize summer drainage that must be pumped out of the Sutter Basin. The project could require construction of check structures, modification of existing canals, and installation of new lift pumps within RD 1500 and SMWC.

The study is expected to be completed by spring 2009, and could be implemented by fall 2009, pending the availability of public funds for implementation. The Department is funding the study through the Agricultural Water Use Efficiency Program (WUE). Initial estimates of potential increased drainwater reuse are on the order of 5,000 to 15,000 ac-ft annually. Actual increased reuse capacity will depend on the selected preferred alternative and available water supply (e.g., water-year type).

Targeted benefits for this project are listed in Table 4-1.

### 5.18.2 Schedule

The project schedule shown in Table 5-18 will commence upon appropriation of funding.

# TABLE 5-18 SMWC and RD 1500 Joint Sutter Basin Drainwater Reuse Project Schedule 2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks			Proje	ect St	atus –	Ongoi	ing an	d Com	pletec	l Work		
Reconnaissance Investigation	Comp	olete										
Feasibility Study	Sche	duled	to be o	comple	eted sp	oring 20	009					
			Р	roject	Durat	ion – V	Vork t	o be C	omple	eted		
		Yea	ar 1			Yea	ar 2			Ye	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Design												
Environmental Documentation and Permitting												
Construction												

### 5.18.3 Cost and Funding Sources

The feasibility study was partially funded by the Department through WUE for approximately \$182,000. Upon completion of the study, a monitoring plan will need to be developed and implemented for pre-project development and post-project reporting. An additional \$200,000 is estimated for completion of pre-design. An order-of-magnitude cost estimate for design and construction of the project will be developed as part of the study, expected to be completed by January 2009. The cost estimate will be refined during the final design. To conduct the pre-design, SMWC and its basin partners are seeking funds from state and federal sources in addition to working with the Sacramento Valley Water Management Program. Indications point to the economic and technical viability of this project, and the project partners will continue to pursue funds for the implementation of the entire project after a cost estimate has been completed as part of the current study effort. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.19 SMWC Canal Lining Project

### 5.19.1 Project Description

SMWC proposes lining approximately 1.3 miles of its lateral system. This project is expected to conserve 500 to 1,000 ac-ft of water per year. The canal lining would include one 0.6-mile section along Lateral F and one 0.7-mile section along Lateral D. Both of these sections are currently subject to significant seepage and annual bank failures.

Targeted Benefits for this project are listed in Table 4-1.

### **5.19.2** Schedule

The project schedule shown in Table 5-19 will commence upon appropriation of funding.

### 5.19.3 Cost and Funding Sources

The cost for the development of the SMWC Canal Lining Project is estimated to be \$350,000. The cost estimate will be refined during the final design. SMWC is seeking public assistance to implement this program through the SVWMP and California State Proposition 50 Grants. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.20 SMWC and RD 1500 Joint Sutter Basin Groundwater Management Program

### 5.20.1 Project Description

SMWC, in partnership with RD 1500, proposes installing six groundwater production wells with an estimated capacity of 1,000 to 1,500 gpm, pumped over a 153-day period. This project is expected to provide a maximum annual contribution of 5,000 ac-ft of water supply. Also installed as part of this project would be six multi-completion groundwater monitoring wells. This project would help SMWC meet the following objectives:

- Increase SMWC water supply reliability and flexibility
- Increase in-stream flows during dry years
- Increase in-basin water supply reliability and flexibility
- Contribute to satisfying the requirements of the Phase 8 Settlement Agreement

Targeted Benefits for this project are listed in Table 4-1.

### 5.20.2 Schedule

The project schedule shown in Table 5-20 will commence upon appropriation of funding.

TABLE 5-20
SMWC and RD 1500 Joint Sutter Basin Groundwater Management Program Schedule 2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks			Proje	ect Sta	atus –	Ongoi	ng an	d Com	pleted	Work		
Pre-design	Comp	leted	in 200	5								
Groundwater Management Planning	-	Ongoing; accomplished in conjunction with RD 1500, SVWMP, and Sutter County										
<b>Environmental Document</b>	In pro	gress	; to be	comp	leted l	by sprin	ng 2009	9				
			Pı	oject	Durat	ion – V	Vork t	o be C	omple	ted		
		Yea	ar 1			Yea	ar 2			Yea	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Install Groundwater Monitoring Infrastructure	contin	ually	installe	ed; the	first p	dditiona priority v 5,000-a	will be	the six				
Final Design												
Permitting			$\Box$									
Construction												
Implementation	•			<b></b>		t least 1 nstrate	_		_		s no	

### 5.20.3 Cost and Funding Sources

The cost for the development of the program is estimated to be \$5 million. SMWC is seeking public assistance to implement this program through the SVWMP and California State Proposition 50 Grants. The development and implementation of this program will be documented in future updates to this RWMP.

### 5.21 PMWC Conjunctive Water Management Program

### 5.21.1 Project Description

The PMWC proposes to develop a conjunctive water management program that will provide up to 1,000 ac-ft of groundwater supply. The water could be used in lieu of a similar quantity of diverted surface water. The PMWC would install one groundwater production well with a capacity estimated between 1,500 and 2,500 gpm to help achieve the following goals:

- Increase system reliability for in-basin users
- Increase system flexibility for in-basin users
- Contribute to satisfying the requirements of the Phase 8 Settlement Agreement

PMWC, as a participant in the Sacramento Valley Water Management Program and through Sutter County, is seeking to establish appropriate levels of groundwater monitoring for successful and responsible management of the groundwater resource.

Targeted Benefits for this project are listed in Table 4-1.

### 5.21.2 Schedule

The project schedule shown in Table 5-21 will commence upon appropriation of funding.

TABLE 5-21
PMWC Conjunctive Water Management Program Schedule
2009 Sacramento Valley Regional Water Management Plan Annual Update

2009 Sacramento Valley Region	ai vvaiti	iviaria	<i>jemen</i>	t i iaii	Allitual	υρυαιτ	1					
<b>Project Tasks</b>		Project Status – Ongoing and Completed Work										
Groundwater Management Planning		oing; ad epartn	_	olished	d in cor	njunctio	n with	RD 15	00, Su	tter Co	ounty, a	and
Preliminary Design	In pro	gress	to be	comp	olete in	2010						
<b>Environmental Document</b>	In pro	gress	to be	comp	oleted I	by sprir	ng 200	8				
			Р	roject	t Durat	ion – \	Nork t	o be C	omple	eted		
		Yea	ar 1			Yea	ar 2			Yea	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Final Design												
Permitting			_									
Construction												
Implementation					For a	t least 1	10 vea	re ae Ir	nna as	there i	s no	

### 5.21.3 Cost and Funding Sources

The cost for the development of the PMWC Conjunctive Water Management Program is estimated to be \$660,000. The PMWC is seeking public assistance to implement this project through the SVWMP and California State Proposition 50 grants. The development and implementation of this program will be documented in future updates to this RWMP.

### 5.21.4 PMWC Canal Lining Project

### 5.21.4.1 Project Description

PMWC lined approximately 1 mile of a canal titled "East 18" in October 2007. This section of canal was subject to significant seepage, weed uptake, and erosion that contributed to canal failures. The new lining is a geomembrane material (Teranap) produced by Siplast, Inc. It is expected to conserve up to 300 ac-ft of water per year.

### 5.21.4.2 Schedule

The project schedule is shown in Table 5-21A.

#### TABLE 5-21A

PMWC Canal Lining Project Schedule

2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks			Proje	ct Sta	tus –	Ongoi	ng an	d Com	pleted	d Work	(	
Engineering Design	Com	pletec	l in sur	mmer 2	2007							
<b>Environmental Document</b>	Com	pletec	l in sur	mmer 2	2007							
Construction	Com	pletec	l in fall	2007								
			Pr	oject [	Durati	on – V	Vork to	o be C	omple	eted		
		Ye	ar 1			Ye	ar 2			Ye	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Design												
Permitting												
Construction					Ш							

### 5.21.4.3 Cost and Funding Sources

The canal lining project cost \$160,000, as estimated. PMWC was awarded \$80,000 from the Fiscal Year 2007 Challenge Grant Program and paid for the remaining \$80,000.

### 5.22 American Sub-basin

Table 5-22 lists and describes potential projects in the American Sub-basin.

TABLE 5-22

Potential Projects in the American Sub-basin

2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Title	District	Sub-basin	Description	Potentia I QO (ac-ft)	Applicable TBs
NCMWC Conjunctive Use Project	NCMWC	American	Utilization of existing groundwater production wells, monitoring and analyzing results	15,000	57, 63, 64, 65
NCMWC American Basin Fish Screen and Habitat Improvement Project – Sankey Diversion	NCMWC	American	Install new pump station and fish screen on Sacramento River	1,400	57, 63, 64, 65
NCMWC SCADA Project for the Natomas Basin	NCMWC	American	Improve flow monitoring in Natomas Basin	4,500	57, 63, 64, 65

### 5.23 NCMWC Conjunctive Water Management Program

### 5.23.1 Project Description

NCMWC proposes to develop a conjunctive water management program that would provide the flexibility to pump and convey groundwater in lieu of some of its surface water supply. This program would be implemented in phases. The initial phase would involve

installation of six new wells and installation and upgrade of the infrastructure to connect the new wells and 13 existing wells to NCMWC's conveyance system. The proposed production wells would likely have capacities that range from 2,500 to 3,500 gpm. This project would help NCMWC meet the following objectives:

- Increase Company water supply reliability and flexibility
- Increase in-stream flows during dry years
- Increase in-basin water supply reliability and flexibility
- Help meet the requirements of the Phase 8 Settlement Agreement

Targeted Benefits associated with this program are listed in Table 4-1.

### 5.23.2 Schedule

The project schedule shown in Table 5-23 will commence upon appropriation of funding.

TABLE 5-23 NCMWC Conjunctive Water Management Program 2009 Sacramento Valley Regional Water Management Plan Annual Update

<b>Project Tasks</b>			Pr	oject	Status	s – Ong	going/	Compl	eted V	Vork		
Groundwater Management Planning and Monitoring	Ongo	ing										
Environmental Document		gress; be re	•		leted I	by sprir	ng 201	0; supp	olemen	ital dod	cument	ation
			P	roject	Durat	tion – \	Nork t	o be C	omple	eted		
		Yea	ar 1			Yea	ar 2			Yea	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Design												
Environmental Documentation/ Permitting												
Construction												
Implementation	•			<b></b>		t least <sup>*</sup> nstrate	•					asin.

### 5.23.3 Cost and Funding Sources

The cost for the development of the NCMWC Conjunctive Water Management Program would be approximately \$5 million. NCMWC is seeking public funding to help implement this program through the SVWMP and state and federal agencies. The development and implementation of this program will be documented in future updates to this RWMP.

# 5.23.4 NCMWC American Basin Fish Screen and Habitat Improvement Project – Sankey Diversion

### 5.23.4.1 Project Description

This project involves the construction of a new 434-cfs pump station on the Sacramento River near Sankey Road. Each of the five pumps in the station will independently draw water through a positive-barrier fish screen, pump the water over the levee, and discharge it into the proposed new Sankey Highline Canal.

NCMWC's current system raises the water surface in the Natomas Cross Canal to draw water through two existing pumping plants. This canal runs into the Sacramento River approximately 1,000 feet upstream of the proposed pumping plant. The increase in efficiency from replacing the existing diversion system with the single new facility would save 1,400 ac-ft of water annually.

Targeted Benefits associate with this project are listed in Table 4-1.

### 5.23.4.2 Schedule

The project schedule is shown in Table 5-23A.

#### TABLE 5-23A

NCMWC American Basin Fish Screen and Habitat Improvements Project – Sankey Diversion 2009 Sacramento Valley Regional Water Management Plan Annual Update

Project Tasks			Proje	ct Sta	tus –	Ongoi	ng an	d Com	pleted	d Worl	<	
Engineering Design	Com	pleted	d early	2009								
Environmental Document	In pr	ogres	s; to be	e comp	oleted	winter	2009					
Construction	To s	tart in	winter	2009/	2010	upon re	elease	of fun	ding			
			Pr	oject l	Durati	ion – V	Vork to	o be C	omple	eted		
		Ye	ar 1			Ye	ar 2			Ye	ar 3	
	1	2	3	4	1	2	3	4	1	2	3	4
Design	I	I	1									
Dormitting				T								
Permitting		•										

### 5.23.4.3 Cost and Funding Sources

Approximately \$1.5 million have been received from CALFED and Reclamation for design and permitting. NCMWC is currently negotiating with CALFED and Reclamation for the remaining \$24 million to build the Sankey Diversion Facilities. The development of this project will be documented in future updates to this RWMP.

### 5.23.5 NCMWC SCADA Project for the Natomas Basin

### 5.23.5.1 Project Description

This project proposes to install and operate a SCADA system in the Natomas Basin. SCADA would continuously collect flow data at selected locations to better direct the flow of irrigation water throughout the basin. The system would extend beyond NCMWC boundaries to include neighboring Reclamation District 1000 (RD 1000). Benefits include increased public safety, reduced power use, and increased water savings, estimated at 4,000 to 5,000 ac-ft/yr.

### 5.23.5.2 Schedule

5-38

This project is being conducted in phases consisting of funding and construction. Phase 1a is funded and currently under construction. Phase 1b is funded and waiting the completion of Phase 1a. Phase 2a is planned and currently waiting funding. A grant request for Phase 2a has been submitted. Additional phases will be added as funding becomes available.

### 5.23.5.3 Cost and Funding Sources

NCMWC applied for project funding through the Proposition 50 WUE Grant in 2007. The total estimated cost for this project is \$350,000. The grant awarded \$163,000, and NCMWC paid the remaining \$187,000.

#### **SECTION 6.0**

# **Establishment of Monitoring Program**

Section 6.0 revisions to the RWMP are highlighted below in shaded text. Revisions to Section 6.0 were focused on updating the Sacramento Valley Water Quality Coalition water quality monitoring activities and the proposed baseline flow determination approach.

This section documents the current water quality and flow measurement capabilities of each participating SRSC and proposes a plan to monitor progress in satisfying QOs resulting from the implementation of water projects. As described in Section 4.0 of this document, QOs were developed by evaluating and identifying the potential quantity of water that could potentially be made available given the implementation of various projects considered to be feasible. Monitoring the performance of each project will be guided by the development of project-specific performance and monitoring plans, including mapping monitoring locations. The primary method of monitoring a project's contribution to a QO is flow measurement at the diversion point on the Sacramento River. SRSCs currently monitor their diversions during specific periods. Changes to river diversions can be quantified and compared with similar water years, including changes in the timing of diversions. It is proposed that baseline flows be identified using recent and historical diversion records by year type, and that future monitoring use a combination of diversion measurement and projected water made available in mutual agreement between the project proponent and Reclamation.

As identified in the RWMP, the status of baseline and monitoring development and mapping will be documented in each RWMP annual update. As summarized in Section 2.0, a number of projects have been proposed for implementation but have not yet been funded. Smaller scale projects have been implemented directly by some districts using district funds. No projects capable of making a significant contribution to meeting QOs were funded in 2008.

System improvement projects proposed to date have included system automation, new gates and ramp flumes, measurement devices, recycling programs, pipe or canal lining, and regulatory reservoirs. Reducing conveyance leakage through the lining of canals or installation of pipelines results in decreased transportation loss and/or percolation. Projections have been made for such projects, but identifying actual savings will need to be quantified by comparing pre-project and post-project data. Methods would include seepage and/or ponding tests. It is recommended that the agreed upon measurement approach be tailored to the specific project incorporated as part of the initial phases of implementation as recommended in the RWMP.

It is important to recognize that such projects result in either reduced "losses" or a reduction in tailwater. In many areas it is neither practical nor advisable to eliminate all tailwater, as it is often reused either within a district or by an adjoining district (particularly in the Colusa Sub-basin) as a source of supply. Thus, the water made available to meet a given QO should be evaluated with respect to total sub-basin water use and demand as appropriate. The "optimum" tailwater flow is influenced by many factors including hydrology, cropping

patterns, and individual cultural farming practices. In 2003, the SRSCs conducted the Subbasin-level Water Measurement Study, which included the following objectives:

- Investigate and document the existing sub-basin outflow water measurement facilities
- Evaluate and recommend facility improvements to achieve higher levels of accuracy and/or data collection if deemed appropriate
- Provide cost estimates for recommended measurement facility improvements
- Identify potential issues of implementing a regional approach to water measurement operations, data collection, and use
- Identify the potential benefits of improved sub-basin-level water measurement

Among the recommendations from this study was that outflow measurement be conducted at specific locations in the Colusa, American, Butte, and Sutter Sub-basins to improve the understanding of the quantity and timing of sub-basin outflow. Specific monitoring locations were identified, as well as recommended measurement approach, equipment needs, and associated costs. An initial 2-year phase of the program was recommended, but was not subsequently funded. The SRSCs and the Northern California Water Association (NCWA) continue to seek funding and promote this measurement and monitoring effort. As summarized in the RWMP, the SRSCs intend to work with the Department to purchase and install equipment and calibrate new and existing measuring devices to improve outflow measurement accuracy in these sub-basins. Continuation of this effort, as well as the Cooperative Water Management Study summarized below, will provide useful information and data to assist in the implementation of an overall water measurement program. The program will meet the requirements of regional criteria, improve the understanding of quantity and timing of inflows and outflows at various levels of SRSC agricultural water operations, and provide information necessary to monitor benefits consistent with CALFED QOs.

### 6.1 Cooperative Study Update

The Cooperative Water Measurement Study is scheduled to be completed mid-2010.

# 6.2 Water Quality and the Sacramento Valley Water Quality Coalition

The Sacramento Valley Water Quality Coalition (Coalition) was formed in 2003, to enhance and improve water quality in the Sacramento River, while sustaining the economic viability of agriculture, functional values of managed wetlands, and sources of safe drinking water. The Coalition is composed of more than 8,600 farmers and wetlands managers encompassing more than 1.3 million irrigated acres and supported by more than 200 agricultural representatives, natural resource professionals, and local governments throughout the region to improve water quality for Northern California farms, cities, and the environment.

The Coalition developed and submitted its Regional Plan for Action to the State Water Resources Control Board and the Central Valley Regional Water Quality Control Board

(Water Board) in June 2003. To implement the Regional Plan for Action and to meet the Water Board's Irrigated Lands Regulatory Program (ILRP), the Coalition prepared and submitted a revised Monitoring and Reporting Program Plan (MRPP) on July 25, 2008 (the initial MRPP was submitted in April 2004 and remains in effect through 2008). To effectively implement the MRPP, the Coalition and 10 sub-watershed groups signed a Memorandum of Agreement that defines the respective roles and responsibilities of the sub-watershed groups, as well as the Northern California Water Association. Additionally, the Coalition signed a Memorandum of Agreement with the California Rice Commission to coordinate the respective programs in the Sacramento River Basin. Although water districts are typically not direct members of the Coalition, many districts and companies have encouraged landowners to join and have assisted in grower education through newsletters and information updates. The Coalition is continuing to pursue partnerships with municipalities and urban areas in the region that are developing stormwater management plans and facing increasingly more stringent effluent limitations.

Figure 6-1 shows the sites that were monitored during 2005 through 2008 (Central Valley Board monitoring data for the Sacramento Valley are available at: <a href="http://www.swrcb.ca.gov/centralvalley/water\_issues/irrigated\_lands/monitoring/monitoring\_data/program\_participants/index.shtml#svc">http://www.swrcb.ca.gov/centralvalley/water\_issues/irrigated\_lands/monitoring/monitoring\_data/program\_participants/index.shtml#svc</a>).

Development of the amended MRPP allowed the Coalition to re-evaluate the waterways, identify drainages with the highest and most inclusive agriculture, and use water quality data from those sites to represent other similar areas. On the basis of the results collected by the Coalition to date, the Coalition proposed a much more focused monitoring program. Similarly, the Coalition proposed to conduct more focused monitoring of most trace elements (arsenic, cadmium, lead, nickel, selenium, and zinc) given monitoring to date has demonstrated that these metals do not exceed objectives and are not likely to cause adverse impacts to aquatic life or human health in waters receiving agricultural runoff in the Coalition watershed. Starting in 2009, the Coalition will be monitoring 21 semi-permanent sites; see Table 6-1. Additional sites that have management plan requirements may also be monitored.

TABLE 6-1
2009 Sacramento Valley Coalition Monitoring
2009 Sacramento Valley Regional Water Management Plan Annual Update

Subwatershed	Location	Lat	Long
Butte-Sutter-Yuba	Lower Honcut Creek at Highway 70	39.30915	-121.59542
Colusa Glenn	Walker Creek near 99W and CR33	39.62423	-122.19652
Colusa Glenn	Colusa Basin Drain above KL	38.8121	-121.7741
Lake-Napa	Middle Creek upstream from Highway 20	39.17641	-122.91271
Lake-Napa	Pope Creek upstream from Lake Berryessa	38.64637	-122.36424
Solano-Yolo	Shag Slough at Liberty Island Bridge	38.30677	-121.69337
Butte-Sutter-Yuba	Lower Snake River at Nuestro Road	39.18531	-121.70358
Butte-Sutter-Yuba	Sacramento Slough Bridge near Karnak	38.785	-121.6533
Butte-Sutter-Yuba	Pine Creek at Nord Gianella Road	39.78114	-121.98771

TABLE 6-1
2009 Sacramento Valley Coalition Monitoring
2009 Sacramento Valley Regional Water Management Plan Annual Update

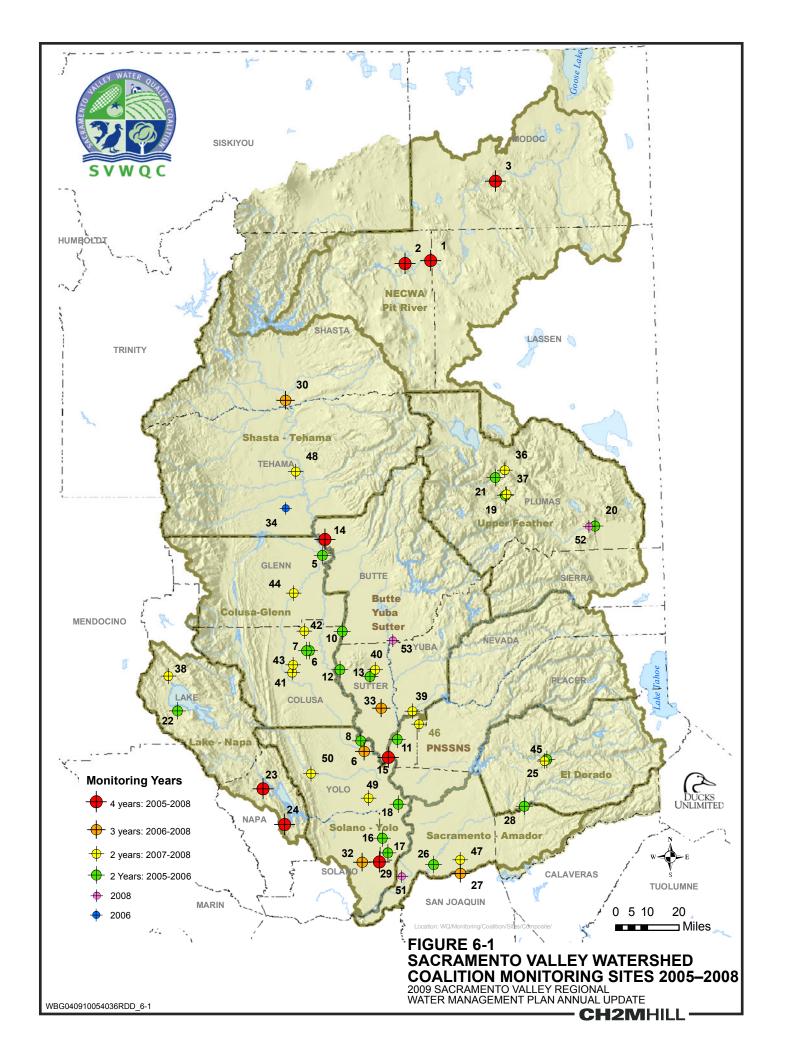
Subwatershed	Location	Lat	Long
Colusa Glenn	Freshwater Creek at Gibson Road	39.17664	-122.18915
El Dorado	North Canyon Creek	38.7604	-120.7102
Pit River	Pit River at Pittville	41.0454	-121.3317
PNSNSS	Coon Creek at Brewer Road	38.93399	-121.45184
Sac-Amador	Cosumnes River at Twin Cities Road	38.29098	-121.38044
Sac-Amador	Grand Island Drain near Leary Road	38.2399	-121.5649
Shasta-Tehama	Anderson Creek at Ash Creek Road	40.418	-122.2136
Solano-Yolo	Willow Slough Bypass at Pole Line	38.59015	-121.73058
Solano-Yolo	Ulatis Creek at Brown Road	38.307	-121.794
Upper Feather	Middle Fork Feather River above Grizzly Creek	39.816	-120.426
Upper Feather	Spanish Creek below Greenhorn Creek	39.9735	-120.9103
Upper Feather	Indian Creek at Arlington Bridge	40.0846	-120.9161

The Water Board Executive Officer, Pamela Creedon, on September 12, 2008, granted the Coalition a conditional interim approval of the monitoring program for January 1 through December 31, 2009. The Coalition will be working with the Water Board staff over the next year to address outstanding issues staff have identified with the goal of obtaining long-term approval.

The Coalition is currently updating its Quality Assurance Project Plan, including sampling site specifics and sampling follow-up methodologies. If sampling reveals significant and persistent toxicity as defined in the MRPP or exceedances of relevant water quality objectives, then a diagnostic approach will be used to expand monitoring activities upstream to identify the general source of toxicity or cause(s) of exceedances. If the magnitude and duration of the toxicity or water quality objective exceedance is sufficient to warrant implementation of management practices, then the Coalition will mobilize its partners at the sub-watershed area level to work with growers to implement practices intended to improve water quality. The Coalition will determine the spatial distribution of crops associated with the identified constituent of concern in the affected sub-watershed area. The County Agricultural Commissioners and other local partners will then follow up with growers to discuss the exceedance and possible ways to avoid future exceedances.

### 6.2.1 Sacramento Valley Management Plan

To address multiple exceedances of the same constituent at a given site within a 3-year period, the Coalition submitted its Management Plan in September 2008 to the Water Board as required under the ILRP.



This Management Plan includes the following elements, as specified in the ILRP:

- Overall Approach
- Registered Pesticides
- Toxicity in Water and Sediment
- Pathogen Indicators
- Legacy Organochlorines Pesticides
- Trace Metals
- Salinity
- Dissolved oxygen and pH
- List of Exceedances Requiring Management Plan Development and Implementation
- Site-specific Management Plan Implementation

The Coalition's Management Plan approach includes the following elements, consistent with guidance proposed in the Monitoring Reporting Program (MRP) approved by the Water Board in January 2008 (Order No. R5-2008-0005).

- 1. Strategy for identification of potential sources of the observed exceedances
- 2. Process to identify potential additional Management Practices to be implemented to address the exceedances
- 3. Management Practices implementation schedule
- 4. Management Plan completion criteria and performance goals
- 5. Process and schedule for evaluating management plan effectiveness
- 6. Monitoring strategy and schedule
- 7. Identification of the participants that will implement the Management Plan
- 8. Schedule and process for reporting the results of Management Plan actions to Regional Water Board staff

The first Management Plan Progress Report will be submitted in December 2009. This initial Progress Report will include the results of monitoring for the previous year, the results of initial source identification evaluations, documentation of outreach efforts, a summary of completed baseline management practice inventories in priority drainages, and proposed goals for additional management practice implementation. The Progress Report will also include an evaluation of progress toward completion of specific Management Plan elements, and recommendations for continuation or modification of the Management Plan. In subsequent years, Progress Reports will also assess progress toward management practice implementation goals set in previous years.

Interim reporting schedules for source identification efforts will be based on the specific evaluations required. Management Plan Progress Reports will include the results of pesticide application reviews, evaluations of analytical methods, source evaluation, documentation of initial outreach meetings, documentation of any ground-level reconnaissance conducted, and recommendations for the Management Plan monitoring.

### 6.2.2 Diazinon Management Plan

Prior to submitting the Sacramento Valley Management Plan, the Coalition submitted its Diazinon Runoff Management Plan for Orchard Growers in the Sacramento Valley to the Water Board on January 19, 2006. The plan was approved by the Water Board in March 2006. In fulfillment of the requirements set forth in the plan, the Coalition submitted three Annual Reports summarizing the 2005-2006, 2006-2007, and 2007-2008 monitoring objectives, location and results, outreach efforts, grower survey follow-up, and management practices effectiveness. None of the samples obtained in 2005-2006 or 2006-2007 exceeded the diazinon objective. In 2007-2008, the Coalition again monitored two storm series of events. During the second series of storm events, diazinon exceedances were detected in the Colusa Basin Drain. No exceedances were identified in the other four drainages. To date, the Coalition has been unable to identify the source of the exceedance. The Coalition will continue to monitor for diazinon as part of the Coalition's MRP.

### **SECTION 7.0**

# Proposed Budget and Allocation of Regional Costs

Section 7.0 revisions to the RWMP are highlighted below in shaded text. SRSC's water conservation budgets were updated for 2007, 2008, and 2009.

This 3-year water conservation budget (see Tables 7-1 and 7-2) is based on estimates of staff time and materials used for conservation efforts by each of the participating SRSCs. Conservation activities were defined as actions or efforts associated with contributing to efficient water management.

TABLE 7-1 Estimated Amount Spent in 2007

2009 Sacramento Valley Regional Water Management Plan Annual Update

Budget Item	Total Budget, Including Staff Time (\$)
Year 2007-2008	1
Conservation Staff	395,418
Measurement	451,336
CIMIS	1,552
Water Quality	55,144
Agricultural Education Program	9,915
Quantity Pricing	0
Policy Changes	241,172
Contractors' Pumps	773,308
Irrigation System Maintenance	3,998,185
Facilitate Financing of On-farm Systems	0
Line or Pipe Canals/Install Reservoirs	264,671
Delivery Flexibility	269,506
District Spill/Tailwater System	17,607
Optimize Conjunctive Use	602,087
Automate Canal Structures	68,775
Customer Pump Testing	25,000
Total (2007)	7,173,681

TABLE 7-2

Projected Budget and Staff Time Summary for 2008 and 2009 2009 Sacramento Valley Regional Water Management Plan Annual Update

Budget Item	Total Budget, Including Staff Time (\$)
Conservation Staff	411,235
Measurement	469,390
CIMIS	1,614
Water Quality	57,350
Agricultural Education Program	10,312
Quantity Pricing	0
Policy Changes	250,819
Contractors' Pumps	804,240
Irrigation System Maintenance	4,158,113
Facilitate Financing of On-farm Systems	0
Line or Pipe Canals/Install Reservoirs	275,257
Delivery Flexibility	280,286
District Spill/Tailwater System	18,311
Optimize Conjunctive Use	626,170
Automate Canal Structures	71,526
Customer Pump Testing	26,000
Total (2008)	7,459,628
Year 2009	
Conservation Staff	427,684
Measurement	488,165
CIMIS	1,678
Water Quality	59,644
Agricultural Education Program	10,724
Quantity Pricing	0
Policy Changes	260,852
Contractors' Pumps	836,410
Irrigation System Maintenance	4,324,437
Facilitate Financing of On-farm Systems	0
Line or Pipe Canals/Install Reservoirs	286,268

7-2

TABLE 7-2
Projected Budget and Staff Time Summary for 2008 and 2009
2009 Sacramento Valley Regional Water Management Plan Annual Update

Budget Item	Total Budget, Including Staff Time (\$)
Delivery Flexibility	291,498
District Spill/Tailwater System	19,043
Optimize Conjunctive Use	651,217
Automate Canal Structures	74,387
Customer Pump Testing	27,040
Total (2009)	7,758,013

### **SECTION 8.0**

# **RWMP Coordination**

<u>Section 8.0 revisions to the RWMP are highlighted below in shaded text. Contact information was updated for all SRSC conservation coordinators.</u>

Quarterly conference calls or meetings will be attended by the representatives listed in Table 8-1. Any issues that may not affect an individual SRSC, but may impact the region or sub-basin will be addressed at this time. A current list of conservation coordinators for each participating SRSC will be provided with the RWMP annual update.

TABLE 8-1 RWMP Conservation Coordinators

2009 Sacramento Valley Regional Water Management Plan Annual Update

District/Company	Conservation Coordinator	Phone	Email
ACID	Stan Wangberg	530-365-7329	acidstan@sbcglobal.net
GCID	Thad Bettner	530-934-8881	tbettner@gcid.net
PID	Lance Boyd	530-934-4801	lboyd52@aol.com
PCGID	Lance Boyd	530-439-2248	lboyd52@aol.com
RD 108	Lewis Bair	530-437-2221	LBair@rd108.org
RD 1004	Jack Baber	530-458-7459	rd1004@frontiernet.net
MFWC	Danny Ruiz	530-696-2456	dannyruiz@succeed.net
SMWC	Max Sakato	916-765-0187	xminusmax@yahoo.com
PMWC	Scott Tucker	530-735-9355	sctuck@hughes.net
NCMWC	Dee Swearingen	916-419-5936	DSwearingen@natomaswater.co m
RWMP Coordinator	Lewis Bair	530-437-2221	LBair@rd108.org

### **SECTION 9.0**

# References

No changes were made.

